Series 1961, No. 22 Issued June 1965

SOIL SURVEY
MERRIMACK COUNTY
New Hampshire

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Merrimack County, N.H., will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid foresters in managing woodlands; and add to our knowledge of soil science.

Locating Soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county numbered to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs.

Finding Information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of the Soils" and then turn to the section "Use and Management of Soils." In this way, they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units, Capability Units, and Woodland Suitability Groups" at the back of the report will simplify use of the map and report. This guide lists each soil and land type mapped in the county, and the page where each is described. It also lists, for each soil and land type, the capability unit, woodland suitability group, and wildlife suitability group, and the pages where each of these is described.

Foresters and others interested in woodlands can refer to the section "Use of Soils as Woodland." In that section the soils in the county are grouped according to their suitability for trees, and factors affecting the management of woodland are explained.

Engineers and other builders will want to refer to the section "Engineering Interpretations of Soils." Tables in that section show characteristics of the soils that affect engineering.

Scientists and others who are interested will find information about how the soils were formed and how they were classified in the section "Formation and Classification of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in Merrimack County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Facts About the County."

Those interested in the increase of wildlife will find information about habitats and the potential of soils for developing habitats in the section "Use of Soils for Wildlife."

* * * * *

Fieldwork for this survey was completed in 1961. Unless otherwise indicated, all statements in the report refer to conditions in the county at that time. The soil survey of Merrimack County was made as part of the technical assistance furnished by the Soil Conservation Service to the Merrimack County Soil Conservation District.

Cover picture.—A view of a fairly typical farmstead in Merrimack County, showing small fields in pasture, stone fences, and rolling topography.

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SOIL SURVEY OF MERRIMACK COUNTY, NEW HAMPSHIRE

REPORT BY HARVEL E. WINKLEY, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY HARVEL E. WINKLEY, DIRK VAN DER VOET, FRANK J. VIEIRA, EDWARD F. HUTCHINSON, THEODORE L. KELSEY, ANTHONY D. HAMILTON, SIDNEY A. L. PILGRIM, AND BRADFORD HIGGINS, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

MERRIMACK COUNTY has an area of 594,560 acres and is in the south-central part of New Hampshire (fig. 1). About 26 percent of the county is in farms; the rest consists of woodland, roads, and urban areas. The population in 1960 was 67,785. Concord, the largest city, is the county seat and also the State capital.

Merrimack County is principally industrial. Dairying and poultry farming are the most important agricultural enterprises, and hay is the main crop. Livestock, fruit, vegetables, and general farm products are also produced. The county has many commercial apple orchards.

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soils are in Merrimack County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. Knowledge of the kinds of groupings most used in a local soil classification are needed for efficient use of this report.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Hermon and Paxton, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with

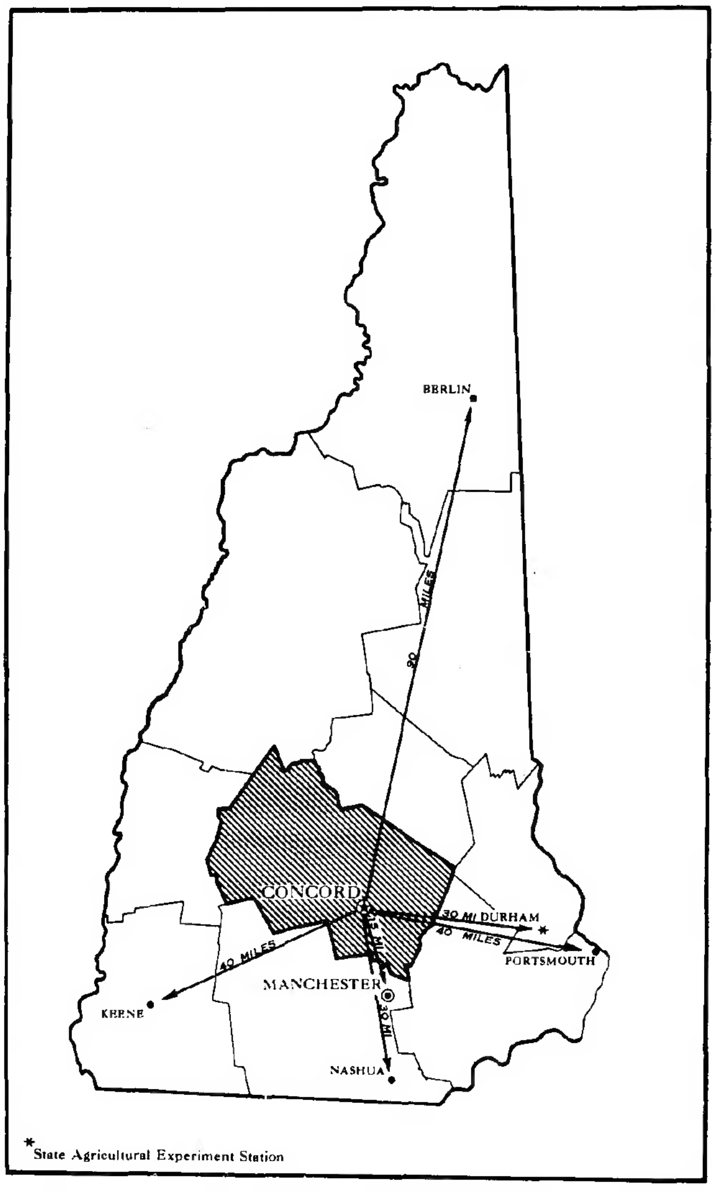

Figure 1.—**Location of Merrimack County in New Hampshire**

their behavior in the natural landscape. Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Hermon sandy loam and Hermon very stony sandy loam are two soil types in the Hermon series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or in some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Hermon sandy loam, 3 to 8 percent slopes, is one of several phases of Hermon sandy loam, a soil type that ranges from gently sloping to moderately steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing soil boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it. Also, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Rock outcrop or Riverwash.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

As one travels throughout Merrimack County, distinct differences in lay of the land can be seen. Some areas are level; others are very steep and mountainous. There are also obvious changes in vegetation. Less easily noticed are the differences in the patterns of soils.

By drawing lines around the different patterns of soil on a small map, one may obtain a general soil map. Each kind of pattern is called a soil association. The pattern is not strictly uniform in each association, but the same soils are present in somewhat the same arrangement. The nature and pattern of soils give each soil association a characteristic landscape of its own.

A map showing soil associations is useful to those who want a general picture of the soils, who want to compare different parts of the county, or who want to locate large areas suitable for some particular kind of farming or other broad land use. Such a map does not show accurately the kinds of soils on a single farm or a small tract.

The six general soil areas, or soil associations, in Merrimack County are shown on the colored map at the back of this report. The areas are named for the major soil series in them, but soils of other series may be present in any of the areas. Detailed information on the individual soils is given in the section "Descriptions of the Soils."

Two of the six soil associations consist of mountains, hills, or rolling uplands; two are mainly sandy, gravelly, or loamy plains and low hills; and two are flood plains and benches along the streams and rivers.

1. Hermon-Canaan-Colton association: Soils on hills and mountains

This association is in a hilly and mountainous area in the western part of the county. It extends in a north-south direction. The ridgetops are sharper, and the hillsides and mountainsides are steeper than those in other parts of the county. The streams flow through narrow valleys, and in most places the flood plain is not wide enough to farm. The area in which this association occurs is higher, generally receives more precipitation, and has lower temperatures than other areas in the county. Stones, boulders, and rock outcrops are numerous and prominent on the landscape.

This association consists mainly of Hermon, Canaan, and Colton soils. The Hermon soils are somewhat excessively drained to well-drained, deep, sandy soils in glacial till. They occupy about 70 percent of the association. The Canaan soils are shallow, sandy soils in glacial till. They occupy about 25 percent of the association. The Colton soils are made up of water-sorted sand and gravel and are distributed throughout the association in small patches. They occupy about 5 percent of the

association. Included with the soils of this association are minor areas of Paxton, Woodbridge, and Whitman soils.

There is less farming in this association than in any of the other associations. More than 85 percent of the acreage is forested, and forests furnish the chief products of the soils. However, there are a few scattered dairy farms and poultry farms.

This association contains many scenic views and is a valuable recreational area, especially near Sunapee Lake. Many areas formerly farmed are now used for summer residences.

2. Colton-Rumney association: Soils on sand and gravel in narrow valleys and on narrow, wet flood plains

This association is narrow and borders streams in the northwestern part of the county. Steeply sloping hills and mountains of association 1 rise from the narrow valleys. The landscape is characterized by wet valleys bordered by narrow strips of sand and gravel.

The Colton and Rumney soils make up most of this association. Colton soils are on nearly level to steep kame terraces and eskers adjacent to and above the wet flood plains. They are droughty sandy and gravelly soils; they occupy about 50 percent of the association. Rumney soils are poorly drained and occur on flood plains that are frequently flooded. They occupy about 50 percent of the association. Included with the soils of this association are minor areas of Duane, Suncook, and Ondawa soils.

Nearly all of this association is forested. Although it has a few dairy and poultry farms, it is not chiefly an agricultural area. Farming is hindered by wet soils and by droughty soils.

3. Hinckley-Windsor-Au Gres association: Sandy and gravelly soils of plains, mounds, ridges, and depressions

This association occurs on nearly level sandy and gravelly plains, sloping terraces, small gravelly mounds, and low gravelly ridges.

The Hinckley, Windsor, and Au Gres are the main soils in this association. The Hinckley soils are excessively drained, gravelly, and loose. They occupy about 45 percent of the association. Windsor soils are excessively drained and sandy, but they have little or no gravel. They occupy about 40 percent of the association. Adjacent to the droughty Hinckley and Windsor soils are the wet, sandy Au Gres soils. These soils occupy about 15 percent of the association and occur in slight depressions and on gently sloping terraces. They are intermingled with the Hinckley and Windsor soils and are kept wet by a high, fluctuating water table. Included with the soils of this association are minor areas of Sudbury and Scarboro soils.

This association is low in agricultural value. Farms usually are partly on it and partly on better agricultural soils. The drier parts of this association are ideal for urban expansion. Many sand pits and gravel pits are in this general area.

4. Paxton-Shapleigh-Woodbridge association: Soils on smooth low hills

This association occurs on spoon-shaped, smooth drumlins of loamy glacial till (fig. 2). The ridgetops generally have broad, smooth, gentle slopes, but the hillsides are much steeper.

This soil association consists mainly of Paxton, Shapleigh, and Woodbridge soils. The Paxton soils are well-drained, deep, loamy soils that have a very firm layer about 2 feet below the surface. They occupy about 40 percent of the association. Near or adjacent to the Paxton soils are the Shapleigh soils. These soils are shallow to bedrock. Because the bedrock is wavy and uneven, the thickness of soil covering the bedrock varies. In some places the bedrock crops out, but in other places it is 12 to 24 inches below the surface. Shapleigh soils occupy about 30 percent of the association. Woodbridge soils are moderately well drained, loamy soils in glacial till that have a firm layer (fragipan) about 2 feet below the surface. They are on broad, nearly level ridgetops, in slight depressions, and on the lower slopes of hillsides. They occupy about 30 percent of the association. Included with the soils of this association are minor areas of Ridgebury and Whitman soils. Figure 3 shows some soil series in relation to the topography of the county.

The better agricultural soils on uplands in Merrimack County are in this association. Dairying, poultry raising, and growing of apples are the main enterprises. Apples are especially well suited because air drainage is good on the ridgetops and the soils are loamy.

5. Gloucester-Shapleigh-Whitman association: Soils on rolling uplands and in scattered swamps

This association is in the hilly area (fig. 3) in the central and eastern parts of Merrimack County. The hills are more rounded and not so steep as those in the northern and northwestern parts. Stones, boulders, and rock outcrops are common. This association is the largest in the county.

This association consists mainly of Gloucester, Shapleigh, and Whitman soils in sandy glacial till. The Gloucester soils are somewhat excessively drained to well-drained, deep, sandy soils in glacial till. They are very near the shallow, sandy Shapleigh soils. Water drains rapidly through both the Gloucester and Shapleigh soils and leaves little moisture available to plants. Scattered throughout the association are wet, swampy depressions containing Whitman soils.

Gloucester soils make up about 60 percent of the association, Shapleigh soils about 30 percent, and Whitman soils about 10 percent. Included with the soils of this association are minor areas of Acton, Ridgebury, and Hinckley soils.

About 85 percent of the acreage is forested, but dispersed throughout are dairy farms (fig. 4), poultry farms, and apple orchards. Small hilly farms are in this area. Farm operations are hindered by small, stony fields bordered by stone fences.

6. Ondawa-Windsor-Agawam association: Soils on flood plains and stream terraces

This association occupies the wider valleys along the larger streams in the county, such as the Merrimack, Pemigewasset, Contoocook, and Suncook Rivers. It consists of nearly level flood plains and nearly level to steep terraces adjacent to the flood plains (fig. 3).

This association consists mainly of Ondawa, Windsor, and Agawam soils. The Ondawa soils are made up of recently deposited sandy alluvium. These frequently

Figure 2.—**Typical landscape in the Paxton-Shapleigh-Woodbridge soil association. Hayfield in foreground is on smooth drumlin. The soil is Paxton loam.**

flooded soils occupy about 50 percent of the association. The Windsor and Agawam are higher lying soils on terraces and are seldom flooded. In most places they are nearly level or gently sloping, but they are steep where the terrace slopes down to the flood plain. Windsor soils are very sandy and dry and hold little moisture. They occupy about 40 percent of the association. Agawam soils contain more silt and slightly more clay in the upper layers than the Windsor soils, but their lower layers are sandy. They occupy about 10 percent of the association. Included with the soils of this association are minor areas of Suncook, Podunk, and Rumney soils.

This association has the largest amount of cleared land in the county. Many large dairy farms are in this area. The soils warm up early in spring. They are easy to work because they contain no stones or gravel that interfere with tillage.

Use and Management of Soils

In this section are discussed use and management of soils for crops and pasture, for woodland, for engineering and other nonagricultural works, and for wildlife. Specific management is not suggested in this section for each soil. Suggestions for the use of each soil are given in the section "Descriptions of the Soils." For more detailed information, consult the local office of the Merrimack County Agricultural Extension Service or Soil Conservation Service, or inquire at the New Hampshire Agricultural Experiment Station at Durham, N.H.

Use of Soils for Crops and Pasture

This subsection has three main parts. The first part explains the capability grouping of soils. In the second, the soils are placed in capability units and the use and management of these are discussed. In the third part, estimated yields of crops are given for each soil under two levels of management.

Capability grouping of soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated

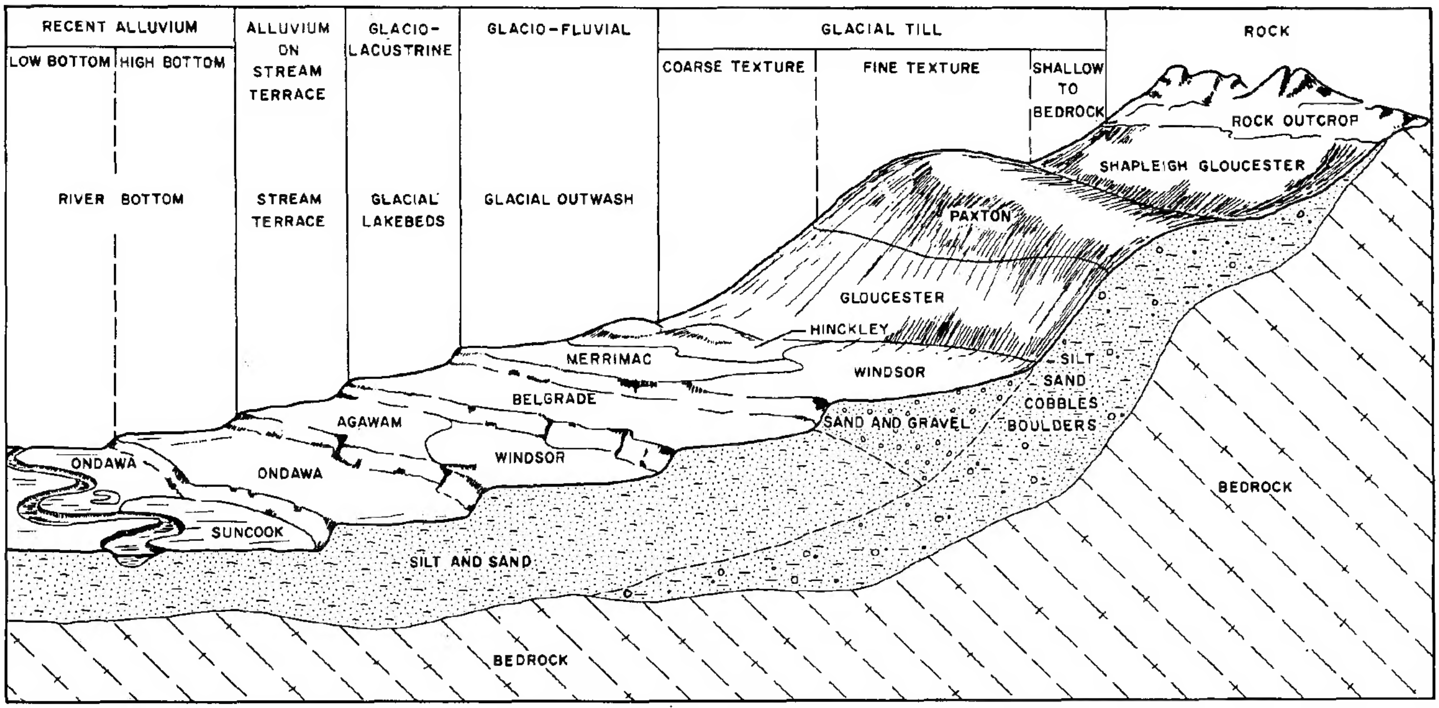

Figure 3.—**Soil series in relation to topography.**

by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

Figure 4.—**Typical landscape in the Gloucester-Shapleigh-Whitman soil association. The main crops are hay and pasture.**

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are subject to little or no erosion but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-2 or IIIe-6.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and capability units in this county, are described in the list that follows. Because the capability classification of soils in Merrimack County is part of a statewide system, all of the capability units in the system

do not occur in this county. Consequently, capability unit numbers in the list are not consecutive.

Class I. Soils that have few limitations that restrict their use.

Capability unit I–1.—Deep, well-drained, nearly level fine sandy loams on flood plains that are seldom flooded.

Capability unit I–2.—Deep, well-drained, nearly level very fine sandy loams on stream terraces above the flood plain.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if they are not protected.

Capability unit IIe–2.—Deep, well-drained gently sloping soils that have a friable subsoil.

Capability unit IIe–6.—Deep, well-drained, gently sloping soils that have a compact subsoil.

Capability unit IIe–56.—Shallow, well-drained, gently sloping soils 12 to 24 inches deep to bedrock.

Subclass IIw. Soils that have moderate limitations because of excess water.

Capability unit IIw–10.—Deep, well-drained, nearly level soils on flood plains and subject to occasional floods.

Capability unit IIw–12.—Deep, moderately well drained, level soils on flood plains and subject to occasional floods.

Capability unit IIw–22.—Deep, moderately well drained, level to gently sloping sandy soils.

Capability unit IIw–32.—Deep, moderately well drained, level to gently sloping silt loams.

Capability unit IIw–52.—Deep, moderately well drained, level to gently sloping sandy soils in the uplands.

Capability unit IIw–62.—Deep, moderately well drained, level to gently sloping loams that have a compact subsoil.

Subclass IIs. Soils that have moderate limitations of moisture capacity.

Capability unit IIs–25.—Nearly level to gently sloping sandy soils that have a loose, gravelly subsoil through which water moves rapidly.

Capability unit IIs–55.—Nearly level to gently sloping, well-drained soils that have a friable subsoil through which water moves freely.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.

Capability unit IIIe-6.—Deep, well-drained, moderately sloping soils that have a compact subsoil.

Capability unit IIIe–25.—Deep, somewhat droughty, moderately sloping soils that have a gravelly subsoil.

Capability unit IIIe–55.—Deep, well-drained, moderately sloping soils that have a friable subsoil.

Capability unit IIIe–56.—Shallow, well-drained, moderately sloping soils 12 to 24 inches deep to bedrock.

Capability unit IIIe–62.—Deep, moderately well drained, sloping soils that have a compact subsoil.

Subclass IIIw. Soils that have severe limitations because of excess water.

Capability unit IIIw–13.—Poorly drained fine sandy loams and silt loams on flood plains subject to frequent floods.

Capability unit IIIw–23.—Level to gently sloping, poorly drained sandy soils that have a friable to loose subsoil.

Capability unit IIIw–63.—Level to gently sloping, poorly drained soils that have a compact subsoil.

Subclass IIIs. Soils that have severe limitations of moisture capacity.

Capability unit IIIs–16.—Sandy, droughty soils on flood plains; subject to rapid leaching.

Capability unit IIIs–26.—Deep, level to gently sloping, sandy or gravelly, droughty soils that have a loose subsoil.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Capability unit IVe–6.—Deep, well-drained, strongly sloping soils that have a compact subsoil.

Capability unit IVe–55.—Deep, well-drained, strongly sloping soils that have a friable subsoil.

Subclass IVs. Soils that have very severe limitations of low moisture capacity.

Capability unit IVs–26.—Deep, sandy and gravelly, excessively drained, moderately sloping soils through which water moves rapidly.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture, woodland, or wildlife food and cover.

Subclass Vw. Soils too wet for cultivation; drainage not feasible.

Capability unit Vw–24.—Nearly level, very poorly drained sandy soils.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture, woodland, or wildlife food and cover.

Subclass VIs. Soils generally unsuitable for cultivation and limited for other uses by stones and outcrops of bedrock.

Capability unit VIs–7.—Deep, well-drained, gently sloping to strongly sloping, very stony soils.

Capability unit VIs–57.—Shallow, gently sloping to strongly sloping, very rocky soils.

Capability unit VIs–72.—Deep, moderately well drained, gently sloping to moderately sloping, very stony soils.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major

reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIw. Soils very severely limited by excess water.

Capability unit VIIw-14.—Very poorly drained, nearly level soils in depressions and on flood plains; subject to frequent floods.

Subclass VIIs. Soils very severely limited by moisture capacity, stones, or outcrops of bedrock.

Capability unit VIIs-7.—Deep, well-drained, steep, very stony soils.

Capability unit VIIs-26.—Steep, sandy, droughty soils that are subject to gullying.

Capability unit VIIs-27.—Steep, gravelly, droughty soils through which water moves very rapidly.

Capability unit VIIs-58.—Moderately sloping to steep, deep and shallow, extremely stony, extremely rocky soils.

Capability unit VIIs-74.—Nearly level to gently sloping, poorly drained to very poorly drained, very stony soils.

Class VIII. Soils and landforms that, without major reclamation, have limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

Subclass VIIIw. Extremely wet or marshy land.

Capability unit VIIIw-89. -Marsh.

Subclass VIIIs. Rock or soil materials that have little potential for production of vegetation.

Capability unit VIIIs-90.—Rock outcrop and riverwash.

Management by capability units

Soils that are in the same capability unit have about the same limitations and similar risks of damage. The soils in one unit, therefore, need about the same kind of management, though they may have formed from different kinds of parent materials and in different ways.

The capability units of this county are described in the following pages. The use and management suitable for each capability unit are discussed, and the soils in each of the units are listed. Gravel pits and Made land, miscellaneous land types, however, were not placed in a capability unit. Only the use of soils for crops and pasture is discussed in this part of the report. Interpretations for woodland, wildlife, engineering, and other nonagricultural uses are presented in detail in other parts of this report.

CAPABILITY UNIT I-1

The only soil in this capability unit is Ondawa fine sandy loam, high bottom. It is a deep, well-drained, nearly level soil on high bottoms of the flood plains. It formed in recent stream deposits. The flooding hazard of this soil is less severe than that of soils on low bottoms. Floods occur only in periods of extremely high water. Water drains through this soil rapidly, but the fine particles hold enough moisture and nutrients for plants.

This soil is suitable for cultivated crops, hay, and pasture. Corn, small grain, grasses, and legumes are well suited, and truck crops are especially well suited. The soil is dry enough to till early in spring and is suitable for early pasture. It is easy to work because it has no stones, cobbles, or gravel. Lime and fertilizer are needed at regular intervals.

Streambank erosion is a major problem, and wind erosion may occur in places. A strip of sod can be left next to the stream to help prevent streambank erosion. Where wind erosion is a problem, fields are planted in strips at right angles to the prevailing wind and to crops of different height and time of maturity. This practice also helps to conserve moisture.

If row crops are grown every year, a winter cover crop is needed to protect the soil and to help maintain yields. Fields subject to wind erosion are used for hay or pasture for 2 years or more. This soil responds well to irrigation and is near a good supply of irrigation water.

CAPABILITY UNIT I-2

The only soil in this capability unit is Agawam very fine sandy loam, 0 to 3 percent slopes. It is a nearly level, deep, well-drained soil that contains large amounts of very fine sand and silt. It is on stream terraces and is seldom flooded. Although water drains through this soil rapidly, a good supply is held available for plants.

This is an excellent agricultural soil. It is suitable for cultivated crops, hay, and pasture. Because it has good drainage, this soil is especially suitable for early pasture. Suitable crops are corn, small grain, grasses, and legumes. Truck crops are especially well suited. For good yields, regular applications of lime and fertilizer are needed.

Erosion is not a problem. The soil is easily worked and is dry enough to till early in spring. Because it has no stones or gravel, it is one of the easiest to till in the county.

This soil is suitable for row crops every year if it is protected by cover crops in winter. It responds well to irrigation. Appropriate use of manure, lime, fertilizer, and cover crops, as well as other good farming practices, are needed to keep this soil productive.

CAPABILITY UNIT IIe-2

The only soil in this capability unit is Agawam very fine sandy loam, 3 to 8 percent slopes. It is a gently sloping, deep, well-drained soil that has a friable subsoil and contains large amounts of water-sorted very fine sand and silt. It is on gently sloping stream terraces and is seldom flooded. Although water drains through this soil readily, a good supply is held available for plants.

This soil is suitable for cultivated crops, hay, and pasture. Because it has good drainage, it is especially suitable for pasture. Corn, truck crops, small grain, grasses, and legumes are well suited. For good yields, regular applications of lime and fertilizer are needed. Because this soil is free of stones and gravel, it is easily tilled. It warms up early in spring.

Field strips, or contour strips, are needed to prevent loss of water and soil. On the longer slopes, diversion ditches are needed to reduce soil erosion. This soil responds well to irrigation. A suitable rotation consists of row crops for 2 years, followed by a winter cover crop, and then hay for 2 years or more.

CAPABILITY UNIT IIe-6

The only soil in this capability unit is Paxton loam, 0 to 8 percent slopes. It is a deep, well-drained, loamy soil in glacial till and has a pan layer at 18 to 24 inches. It is gently sloping and is on drumlins. The pan layer slows the downward movement of water. Water moves

downslope above the pan and comes to the surface as seeps. This soil is wet longer in the spring than other well-drained soils without a pan. It holds moisture well and generally supplies enough for plants.

This soil is suitable for cultivated crops, hay, and pasture. Apple trees also grow well, and many orchards are on this soil. Corn, small grain, grasses, and legumes are well suited. Regular applications of lime and fertilizer are needed. The soil is strongly acid. Stones have been removed from the surface so that modern farm equipment can be used.

The erosion hazard is greatest during rainy periods in spring when the soil is thawing. On long slopes, stripcropping and diversion ditches help to reduce the loss of soil and water.

A cropping system commonly used consists of 2 years of row crops, followed by a winter cover crop, and then 2 years or more of hay. If they are fertilized and harvested properly, hayfields yield well for 4 to 7 years.

CAPABILITY UNIT IIe-56

This capability unit includes only Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes. These soils are shallow, well drained, and generally occur on gently sloping hilltops. The texture ranges from loam to sandy loam. Because the upper surface of the bedrock is irregular, the soils vary in depth. They are generally 12 to 24 inches deep over bedrock, but pockets of deeper soil occur. Rock outcrops are not numerous enough to prevent cultivation.

These soils are droughty during dry periods because of their shallow depth to bedrock. Water moves rapidly through them. In spring when the soil is thawing, water flows downslope above the bedrock and comes to the surface as seeps.

Soils in this unit are suitable for cultivated crops, hay, and pasture. Corn, truck crops, small grain, grasses, and legumes are adapted. Regular applications of lime and fertilizer are needed. The soils are strongly acid. If diversion ditches are built and stripcropping is practiced, a cropping system commonly used consists of 2 years of row crops, followed by a winter cover crop, and then by 2 years or more of hay.

CAPABILITY UNIT IIw-10

The only soil in this capability unit is Ondawa fine sandy loam. It is a deep, well-drained soil on low bottom lands. This nearly level soil is subject to occasional floods. This hazard must be considered in management. Flooding generally occurs early in spring when the snow melts and in fall after crops are harvested. Water moves through the soil rapidly, but enough moisture is held for crops by the fine particles. The roots of deep-rooted plants reach a moist layer, as the soil is on low-lying flood plains close to streams.

Ondawa fine sandy loam is a good agricultural soil. It is suitable for cultivated crops, hay, and pasture, but flooding may delay its use for early pasture. Corn, truck crops, small grain, grasses, and legumes are well suited. For good yields, regular applications of lime and fertilizer are needed. Because it has no stones, cobbles, or gravel, the soil is easy to work.

Streambank erosion is a major problem; a strip of sod next to the streambank helps to prevent it. Field strips planted at right angles to the prevailing wind help to control wind erosion, which occurs in places on this soil.

If row crops are grown every year, a winter cover crop is needed to protect the soil and to help maintain yields.

Where wind erosion or flooding is a problem, a longer rotation that includes at least 2 years of hay or pasture is used. Planting crops having different height and time of maturity helps to conserve moisture and to lessen the hazard of wind erosion. The soil responds well to irrigation, and a good supply of water for irrigation is nearby.

CAPABILITY UNIT IIw-12

The only soil in this capability unit is Podunk fine sandy loam. This deep, moist, nearly level soil formed in stream-deposited sediment on flood plains. Lower lying areas are subject to occasional floods during wet periods. Because the water table is high, this soil has adequate moisture for crops, even during dry periods.

This soil is suitable for cultivated crops, hay, and pasture. Small grain, grasses, and legumes are well suited. Planting of corn and truck crops is sometimes delayed because of floods or wetness. After rains, tillage is often delayed because the soil dries slowly. The soil is good for pasture when the sod is firm enough to resist puncturing by the feet of cattle. Regular applications of lime and fertilizer are needed. The soil has no stones, cobbles, or gravel to interfere with tillage.

Streambank erosion is a problem. During wet seasons, the soil cannot be worked so regularly as well-drained soils. If the wetter areas are artificially drained, a wider variety of crops can be grown and workability is improved.

A cropping system commonly used is 2 years of row crops, followed by a winter cover crop, and then 2 years or more of hay or pasture. If artificial drainage is used and flooding is not a problem, row crops, followed by a winter cover crop, are grown continuously.

CAPABILITY UNIT IIw-22

This capability unit consists of deep, level to gently sloping, moderately well drained, sandy soils on terraces. They have a high water table during wet periods, which may interfere with work after rains. Movement of water is moderately rapid through the soil if the water table is lowered. These soils generally supply plants with adequate moisture during dry periods. The soils are—

Duane fine sandy loam, 0 to 8 percent slopes.
Ninigret very fine sandy loam, 0 to 3 percent slopes.
Sudbury fine sandy loam, 0 to 3 percent slopes.
Sudbury fine sandy loam, 3 to 8 percent slopes.

These soils are suitable for cultivated crops, hay, and pasture. Small grain, grasses, and legumes are well adapted. If the soils are artificially drained, corn and truck crops are well suited. The soils are strongly acid. Regular applications of lime and fertilizer are needed.

The erosion hazard is slight on the nearly level soils and moderate on the gently sloping soils. Because they have no stones, these soils are easy to work. Wetness in spring frequently delays work on these soils. These soils can be successfully drained by lines of tile. Drained areas are workable earlier in spring and are adapted to a wider variety of crops.

A cropping system commonly used in the nearly level fields is 2 years of row crops, followed by a winter cover crop, and then 2 years or more of hay. Nearly level fields

that have been drained can be used for continuous row crops if they are followed by a winter cover crop. A rotation used on gently sloping areas without graded strips consists of a row crop for 1 year, followed by a winter cover crop, and then 3 years or more of hay. On the gently sloping fields that have graded strips, a safe rotation is 2 years of row crops, followed by a winter cover crop, and then 2 years or more of hay.

CAPABILITY UNIT IIw-32

The only soil in this capability unit is Belgrade silt loam, 0 to 8 percent slopes. It is a deep, moderately well drained, level to gently sloping, silty soil in glacial lakebeds. A seasonally high water table keeps the soil wet early in spring, late in fall, and in winter. Water moves slowly through the soil, which remains wet for a few days after rains.

This soil can be used for cultivated crops, hay, and pasture. Regular applications of lime and fertilizer are needed. The soil is strongly acid.

The more sloping areas are easily eroded, and the longer slopes need diversion ditches to reduce runoff. Long slopes should be planted in graded strips to prevent ponding of water and injury to plants.

Row crops are difficult to grow because the length of time that tillage is feasible is limited. The soil is good for grass. A common cropping system used is a row crop 1 year, followed by a winter cover crop, and then 4 years or more of hay.

CAPABILITY UNIT IIw-52

The only soil in this capability unit is Acton fine sandy loam, 0 to 8 percent slopes. It is a nearly level to gently sloping, deep, moderately well drained, moderately coarse textured soil. It occurs in slight depressions, on long gentle hillsides, and at the base of steeper slopes. A pan layer may occur at a depth greater than 30 inches. The pan layer is much softer when wet than when dry. Water moves freely through the soil above the pan layer and slowly through the pan. This moderately well drained soil is wet in spring, late in fall, and for several days after heavy rains because it receives seepage water and has a seasonally high water table. It must be worked later in spring than the well-drained soils. Adequate moisture is supplied for plants during the growing season, even in dry summer months. In wet periods, however, this soil usually has excess water.

This soil is suitable for cultivated crops, hay, and pasture. Corn, small grain, grasses, and legumes are suited. Regular applications of lime and fertilizer are needed. This soil is strongly acid.

Graded strips should be used where possible to prevent ponding of water and injury to plants. On long slopes, diversion ditches help to reduce surface runoff. If the soil is artificially drained, a greater variety of crops can be grown and the soil can be worked sooner after heavy rains. Most stones have been removed, but a few have been left on the surface in places.

A commonly used cropping system is a row crop for 1 year, followed by a winter cover crop, and then 3 years or more of hay. If diversion ditches or artificial drains are used, a row crop, followed by a winter cover crop, is grown for 2 years and then hay is grown for 2 years or more.

CAPABILITY UNIT IIw-62

The only soil in this capability unit is Woodbridge loam, 0 to 8 percent slopes. It is a deep, level to gently sloping, moderately well drained, medium-textured soil in glacial till. It occurs on the crest of broad, smooth drumlins and on the lower slopes of hillsides. It has a pan layer at a depth of about 24 inches. Water moves freely downslope through the soil above the pan layer and comes to the surface as seeps, but it is restricted in the pan. This soil is wet longer in spring than well-drained soils. During dry periods, it supplies adequate moisture for plants.

This soil is suitable for cultivated crops, hay, and pasture. Small grain, grasses, and legumes are well suited. This is a good soil for grass. Artificial drains are used to remove excess water and to increase the kinds of crops that can be grown. Regular applications of lime and fertilizer are needed. The soil is strongly acid.

Erosion is a problem in spring when the soil is thawing. On long slopes, diversion ditches and graded strips help to control erosion. Although most stones have been removed, a few have been left on the surface in places.

A cropping system commonly used consists of a row crop for 1 year, followed by a winter cover crop, and then 3 years or more of hay. If artificial drains are installed, the soil can be used more intensively. For example, 2 years of row crops, followed by winter cover crops and then 3 years or more of hay can be grown.

CAPABILITY UNIT IIs-25

This capability unit consists of nearly level to gently sloping, droughty, sandy soils underlain by gravel. These soils occur on sandy plains and on gently sloping kame terraces of water-sorted material. They are not subject to flooding, as they are well above the level of streams. They are loose and open, so that water moves downward rapidly, and their moisture-holding capacity is low. Crops are damaged by lack of moisture during fairly short periods of dry weather. Many gravel pits are on these soils. The soils are—

Merrimac sandy loam, 0 to 3 percent slopes.
Merrimac sandy loam, 3 to 8 percent slopes.

These soils are suitable for cultivated crops, hay, and pasture. Corn, truck crops, small grain, grasses, and legumes are suited. Yields are low unless the soils are irrigated and heavily fertilized. As leaching is rapid, regular applications of lime and fertilizer are needed.

The erosion hazard is moderate on gently sloping fields. Because the soils have no large stones, they are fairly easy to work, but in places, gravel interferes with the preparation of a good seedbed.

These soils warm early in spring. On long slopes field strips or contour strips are used to conserve water and soil. The content of organic matter is maintained by adding manure and by plowing under cover crops and sod.

Crop rotations are short because perennial hay does not grow well on these droughty soils. Cropping systems commonly used for the gently sloping soils are (1) a row crop for 1 year, followed by a winter cover crop, and then 3 years of hay; and (2) a row crop for 1 year, followed by a winter cover crop, and then an annual hay crop, followed by 2 years of hay. On nearly level fields, row crops, followed by winter cover crops, are grown for 2 years, and then hay is grown for 2 years or more.

Figure 5.—Diversion ditch being built on a sloping field to help control surface water and erosion.

For successful yields every year, irrigation is needed, as well as heavy fertilization, early seeding, and short rotations.

CAPABILITY UNIT IIs-55

This capability unit consists of nearly level to gently sloping, deep, well-drained soils that have a friable subsoil. They are underlain by sandy glacial till. Water moves through these soils rapidly, and they retain less moisture for plants than the finer textured soils. The soils are—

Gloucester sandy loam, 3 to 8 percent slopes.
Hermon sandy loam, 3 to 8 percent slopes.

These soils are suitable for cultivated crops, hay, and pasture. Corn, truck crops, orchards, small grain, grasses, and legumes are well suited. For good yields, regular applications of lime and fertilizer are needed. Alfalfa grows well on these soils if adequate amounts of lime and fertilizer are added.

Although most stones have been removed, a few large ones have been left on the surface in places. Because these soils contain stones, cobbles, and gravel, they are only moderately easy to work. The erosion hazard is reduced by the large amount of coarse material in these soils.

Cultivated fields can be protected from erosion by diversion ditches (fig. 5), field strips, and contour strips. If vegetables are grown, terraces can be used. A cropping system commonly used consists of a row crop for 1 year, followed by a winter cover crop, and then 3 years or more of hay.

CAPABILITY UNIT IIIe-6

The only soil in this capability unit is Paxton loam, 8 to 15 percent slopes. It is a deep, medium-textured, well-drained soil in glacial till. It has a pan layer at a depth of about 24 inches. The soil is moderately sloping and is on the sides of smooth drumlins. Water moves freely through the part above the pan layer but slowly through the pan. Above the pan layer, the water moves downslope and comes to the surface as seeps. This soil is wet longer in spring than soils without a pan. In dry periods, however, it supplies enough moisture for plants.

This soil is suitable for cultivated crops, hay, and pasture. It is a good soil for grass. Small grain, grasses, and legumes are well suited. Many apple orchards are on this soil. Regular applications of lime and fertilizer are needed. The soil is strongly acid.

Erosion is a problem in spring when the soil is thawing. On long slopes diversion ditches and stripcropping help to control erosion. Most stones have been removed from the surface.

A common cropping system is 1 year of a row crop, followed by a winter cover crop, and then 3 years or more

of hay. If diversion ditches are built, a row crop, followed by a winter cover crop, is grown for 2 years, and then hay is grown 2 years or more.

CAPABILITY UNIT IIIe-25

The only soil in this capability unit is Merrimac sandy loam, 8 to 15 percent slopes. This is a deep, somewhat droughty, sandy soil underlain by gravel. It is on moderately sloping, irregular kame terraces of water-sorted materials. These terraces are small hills or mounds that have complex slopes and are so cut by drains that cultivation is difficult.

This soil is not subject to flooding. It is loose and open, so that water moves downward rapidly, and the water-holding capacity is low. Crops are damaged by lack of moisture during fairly short dry periods. Many gravel pits are on this soil.

This soil is suitable for hay, pasture, and cultivated crops. It is best suited to alfalfa and other deep-rooted hay crops. As leaching is rapid, regular applications of lime and fertilizer are needed.

The erosion hazard is most severe early in spring when the soil is thawing and when the rate and amount of runoff are greatest. Because it has complex slopes and many drains, this soil is difficult to work. It warms up early in spring.

Where practical, this soil is seeded in field strips for hay. An occasional row crop is grown to help eliminate native grasses before the hay crop is seeded again. Row crops can be grown more frequently where slopes are only about 8 to 10 percent and are less complex than normal. However, irrigation is needed for high yields.

CAPABILITY UNIT IIIe-55

This capability unit consists of moderately sloping, well-drained, deep soils that have a friable subsoil. They are underlain by sandy glacial till. Water moves rapidly through these soils, and they retain less moisture for plants than the finer textured soils. The soils are—

Gloucester sandy loam, 8 to 15 percent slopes.
Hermon sandy loam, 8 to 15 percent slopes.

These soils are suitable for cultivated crops, hay, and pasture. Corn, orchards, small grain, grasses, and legumes are well suited. For good yields, regular applications of lime and fertilizer are needed. Alfalfa grows well if adequate amounts of lime and fertilizer are added.

Although most stones have been removed, a few large ones have been left on the surface in places. Because these soils contain stones, cobbles, and gravel, they are only moderately easy to work.

Cultivated fields on these moderately sloping soils need protection from erosion. Diversion ditches help to keep surface water from flowing across fields. Field strips and contour strips of the right width also help to slow runoff and to control erosion. A common cropping system on these soils is 1 year of a row crop, followed by a winter cover crop, and then 4 years or more of hay.

CAPABILITY UNIT IIIe-56

The only soils in this capability unit are mapped as Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes. These soils are shallow, well drained and occur on hillsides. Because the upper surface of the bedrock is irregular, the soils vary in depth. Generally they are 12 to 24 inches deep to bedrock, but deeper pockets occur. Rock outcrops are not numerous enough to prevent cultivation. These thin soils are droughty in dry periods.

Water moves through these soils rapidly. In spring when the soil is thawing, water moves downslope above the bedrock and comes to the surface as seeps.

These soils are suitable for cultivated crops, hay, and pasture; corn, small grain, grasses, and legumes are suited. Regular applications of lime and fertilizer are needed. The soils are strongly acid.

Erosion is likely, and precaution must be taken on these strongly sloping soils. If the surface is smooth enough for diversion ditches, field strips, and contour strips, row crops can be safely grown for 1 year, followed by a winter cover crop, and then by 3 years or more of hay. Without stripcropping and diversion ditches, the most intensive safe use is for grass.

CAPABILITY UNIT IIIe-62

The only soil in this capability unit is Woodbridge loam, 8 to 15 percent slopes. It is a sloping, deep, moderately well drained, medium-textured soil in glacial till on the sides of drumlins and other hills. It has a pan layer at a depth of about 24 inches. Water moves freely through the soil above the pan layer. It moves downslope above the pan layer and comes to the surface as seeps. This soil is wet later in the spring than well-drained soils. During dry seasons, however, it supplies adequate moisture for plants.

The soil is suitable for grass, but if erosion is controlled, it is suitable for cultivated crops. Its best use is for hay and pasture. Small grain, grasses, and legumes are well suited, but corn is not well suited. Use of the soil is limited by the risk of erosion and by moderate drainage. Truck crops are difficult to grow because of the slope, the pan layer, and moderate drainage. Regular applications of lime and fertilizer are needed. The soil is strongly acid.

Erosion is a problem in spring when the soil is thawing. Although most stones have been removed, a few have been left on the surface in places.

Artificial drainage is frequently needed in orchards. On long slopes diversion ditches and graded strips help to control erosion. If diversion ditches are built, row crops or other annual crops are grown for 1 year before reseeding a grass-legume mixture. The grass-legume mixture is maintained for 3 years or more. Areas where diversion ditches are not built are used for grass.

CAPABILITY UNIT IIIw-13

This capability unit consists of nearly level, poorly drained soils in depressions on the flood plains. They are saturated for long periods and are subject to frequent floods. The soils are—

Limerick silt loam, high bottom.
Rumney fine sandy loam.

Because of poor drainage or flooding, or both, these soils are slow to warm in spring. In many places their best use is for hay. Grazing is restricted to periods when the soil is firm and not saturated with water. Where drainage is feasible, row crops, small grain, grasses, and legumes can be grown. Regular applications of lime and fertilizer are needed for good yields.

Not many fields are artificially drained, because outlets are inadequate. In many places artificial drainage is not

feasible, because the soil and the stream are at about the same level, and open ditches do not lower the water table enough to improve drainage.

These soils are easy to work when they are dry because they have no stones, cobbles, or gravel. The common cropping practice is to reseed regularly with a mixture of perennial plants for hay.

CAPABILITY UNIT IIIw-23

This capability unit consists of poorly drained, sandy soils that developed in water-sorted material in depressions on nearly level sandy plains and on gently sloping terraces. They have a friable to loose subsoil. These soils are kept wet by a seasonally high water table that is within a few inches of the surface late in fall, in winter, and early in spring. During dry periods, however, the water table is at a depth of about 6 feet. The use of farm machinery is limited to dry periods. Water moves rapidly through these sandy soils when the water table is low. The soils are—

Au Gres fine sandy loam, 0 to 3 percent slopes.
Au Gres fine sandy loam, 3 to 8 percent slopes.
Au Gres loamy sand, 0 to 8 percent slopes.

In their natural condition, these soils are best suited to hay. They can be used for pasture only during limited periods when the sod is firm. The soils are strongly acid. They need regular applications of lime and fertilizer. Grasses and legumes are suited to these soils, but because of poor drainage, alfalfa is not suited. Corn and truck crops are seldom grown.

These soils are frequently drained by tile and by open ditches. They are easily drained, as water moves through the sandy material rapidly. Artificial drainage widens the range of crops that can be grown and makes the soils workable for longer periods.

If these soils are adequently drained, they are suitable for cultivated crops, hay, and pasture. Grasses, legumes, corn, and truck crops are suited to the drained soils. After drainage, a common cropping system used is a row crop 1 year, followed by a winter cover crop, and then 3 years or more of hay.

CAPABILITY UNIT IIIw-63

This capability unit consists of level to gently sloping, poorly drained, medium-textured soils in glacial till. These soils have a pan layer. They occupy depressions in the uplands; broad, nearly level crests of hills; and the lower slope of hillsides. They are generally saturated because of a high water table and are waterlogged late in fall, in winter, and most of the time in spring. Water that falls on these soils or drains onto them may be temporarily ponded. The soils are—

Ridgebury loam, 0 to 3 percent slopes.
Ridgebury loam, 3 to 8 percent slopes.

Because of poor natural drainage, these soils are best suited to hay and pasture. Grasses, legumes, and small grain are suited. Regular applications of lime and fertilizer are needed. The soils are strongly acid. They are slow to warm up in spring.

Crops grown on these soils have a short growing season, as planting is delayed by wetness in the spring. Because of poor natural drainage, hay and pasture fields are usually reseeded directly to a grass-legume mixture without growing a row crop. A close-growing annual, however, is sometimes grown to help reduce the amount of native grasses and weeds before reseeding.

CAPABILITY UNIT IIIs-16

The only soil in this capability unit is Suncook loamy sand. It is a nearly level, sandy, excessively drained soil on flood plains. Because this soil is on low-lying bottom lands near streams, it is subject to frequent floods. The frequency and duration of floods vary widely because of the slight differences in elevation of the soil. Because this soil is open loamy sand, water drains downward rapidly, and little water is held for plant use.

This soil has a low potential value for agriculture because it is very droughty. It is suitable for limited use for cultivated crops, hay, and pasture. Corn, small grain, grasses, and legumes are grown. Regular applications of lime and fertilizer are needed, as soil leaching is rapid.

This soil dries out early in spring. As it has no stones, it is easy to till. Generally, irrigation is needed for satisfactory yields. Because the soil is close to water, irrigation is generally possible.

Short rotations are used, as this droughty soil does not support perennial hay plants. A cropping system commonly used is a row crop, followed by a winter cover crop, and then 2 years or more of hay. Because this soil is adjacent to streams, streambank erosion is a major problem.

CAPABILITY UNIT IIIs-26

In this capability unit are deep, excessively drained, very droughty, sandy and gravelly soils on sandy plains and kame terraces. They are nearly level to gently sloping soils in water-sorted sand and gravel that contain very little silt and clay. Water moves rapidly through these soils and they hold little moisture available for plants. The Windsor soils are deep, sandy soils with little gravel and have a slightly better moisture-holding capacity than the Hinckley and Colton soils, which have gravelly layers. Many sand and gravel pits are on these soils. The soils are—

Colton loamy sand, 0 to 3 percent slopes.
Colton loamy sand, 3 to 8 percent slopes.
Hinckley loamy sand, 0 to 3 percent slopes.
Hinckley loamy sand, 3 to 8 percent slopes.
Windsor loamy sand, 0 to 3 percent slopes.
Windsor loamy sand, 3 to 8 percent slopes.

The soils in this unit are open and loose and have a low potential value for agriculture without irrigation. These very droughty soils can be used for cultivated crops, hay, and pasture, but irrigation is needed for a successful crop every year. They warm early in spring and are fairly easy to work, as they have no stones in most places. In some places, however, gravel and cobbles interfere with tillage. The soils are strongly acid. Because the soils leach rapidly, they need regular applications of lime and large amounts of fertilizer, which make farming expensive.

The erosion hazard is slight to moderate. The Windsor soils are subject to wind erosion if not protected. Special practices are needed to maintain the organic-matter content. These include the use of manure and the plowing under of cover crops and sod.

Cropping systems must be short, as perennial hay and pasture plants do not grow well on these droughty soils. These soils are best suited to alfalfa and other deep-rooted hay plants. A common rotation is a row crop 1 year, followed by a winter cover crop, and then 2 years

of hay. A cropping system used for terraced areas is 2 years of row crops, followed by a winter cover crop, and then a green-manure crop. On long sloping fields, the land is worked in field strips or contour strips to help control runoff.

CAPABILITY UNIT IVe-6

The only soil in this capability unit is Paxton loam, 15 to 25 percent slopes. It is a strongly sloping, deep, well-drained, loamy soil in glacial till. It occurs on the sides of drumlins. A pan layer at a depth of 18 to 24 inches slows the downward movement of water. Water flows downslope above the pan layer and comes to the surface as seeps. Because it has a compact subsoil, this soil is wet longer in spring than other well-drained soils on uplands. It holds moisture well and generally supplies enough for good plant growth.

Probably the best use of this soil is for hay and pasture because of its very strong slopes. A grass-legume mixture is generally grown for hay and pasture. Regular applications of lime and fertilizer are needed. The soil is strongly acid.

The erosion hazard is severe, and a protective cover of sod is needed. Fields are generally reseeded directly to a grass-legume mixture, but a close-growing crop is sometimes grown to help reduce the number of weeds and native grasses before reseeding. On less sloping fields, where stripcropping can be used, a row crop can be grown before reseeding to a hay or pasture mixture.

CAPABILITY UNIT IVe-55

This capability unit consists of strongly sloping, deep, well-drained soils underlain by sandy glacial till. They have a friable subsoil. Water moves through these soils rapidly, and they retain less moisture for plants than the finer textured soils. The soils are—

Gloucester sandy loam, 15 to 25 percent slopes.
Hermon sandy loam, 15 to 25 percent slopes.

These soils are suitable for hay and pasture. They are well suited to early pasture, as the soils warm early in the spring. For good yields, regular applications of lime and fertilizer are needed. These very strongly sloping soils are susceptible to erosion and need to be protected by a good sod. Although most stones have been removed, a few large ones have been left on the surface in places. Because these soils contain stones, cobbles, and gravel, they are only moderately easy to work. Soils on the steeper slopes are difficult to work safely with tractors.

If feasible, fields should be worked in contour strips or field strips because of strong slopes. If field strips or contour strips are used, corn or small grain can be grown for one year to help prepare the land for reseeding to hay or pasture.

CAPABILITY UNIT IVs-26

In this capability unit are moderately sloping, deep, droughty, sandy and gravelly soils on kame terraces. They are in water-sorted material that contains little silt and clay. The Windsor soils are deep and sandy and have little gravel; the Hinckley and Colton soils have gravelly layers. Water moves rapidly through these soils, and they hold little moisture available for plants. They are a good source of sand and gravel. The soils are—

Colton loamy sand, 8 to 15 percent slopes.
Hinckley loamy sand, 8 to 15 percent slopes.
Windsor loamy sand, 8 to 15 percent slopes.

Soils in this unit are suitable for hay, pasture, or woodland. Because these soils are subject to rapid leaching, frequent applications of lime and fertilizer are needed. Coarse texture, short irregular slopes, erosion hazard, and droughtiness make these soils suitable for only an occasional row crop. Alfalfa or other deep-rooted crops should be grown for hay.

The Windsor soils are easily gullied and are subject to wind erosion. A protective plant cover is needed to minimize erosion. Many old fields and pastures have been planted to trees.

CAPABILITY UNIT Vw-24

The only soil in this capability unit is Scarboro fine sandy loam. It is a nearly level, very poorly drained, sandy soil in depressions on sandy plains. It is waterlogged most of the time and, in places, water is on the surface.

This soil is suitable for permanent pasture or for woodland. Wetness prevents more intensive use. This soil is usually too wet to support farm machinery. It provides only low-quality pasture of water-tolerant plants. In most places, good outlets are not available for drainage. Even if drainage is feasible, wetness is still a problem, and the most intensive use is for hay and pasture. These soils generally provide good sites for farm ponds.

CAPABILITY UNIT VIs-7

This capability unit consists of gently sloping to strongly sloping, very stony, deep, well-drained soils in glacial till. They are moderately coarse textured to medium textured and are loose to compact. Stones and boulders on these soils seriously interfere with the use of farm machinery. The soils are—

Gloucester very stony sandy loam, 3 to 8 percent slopes.
Gloucester very stony sandy loam, 8 to 15 percent slopes.
Gloucester very stony sandy loam, 15 to 25 percent slopes.
Hermon very stony sandy loam, 3 to 8 percent slopes.
Hermon very stony sandy loam, 8 to 15 percent slopes.
Hermon very stony sandy loam, 15 to 25 percent slopes.
Paxton very stony loam, 3 to 8 percent slopes.
Paxton very stony loam, 8 to 15 percent slopes.
Paxton very stony loam, 15 to 25 percent slopes.

These soils are suitable for permanent pasture and for woodland (fig. 6). Numerous stones and boulders on the surface prevent the use of modern farm equipment. Many areas of permanent pasture on these soils are gradually being abandoned and replaced by pastures that can produce forage of higher quality. These stony areas are reverting to woodland in many places by natural reseeding. In some areas, stones can be removed from the surface, and the soil can be used more intensively.

CAPABILITY UNIT VIs-57

This capability unit consists of gently sloping to strongly sloping, shallow soils that developed in glacial till. They are moderately coarse textured and are somewhat droughty. Their outstanding features are numerous outcrops of bedrock and shallowness. Bedrock is within 10

Figure 6.—**Red pine planted on Gloucester very stony sandy loam, 3 to 8 percent slopes. Areas not suitable for farming are often planted to trees.**

to 20 inches of the surface in most places. The soils are—

Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes.
Canaan-Hermon very rocky sandy loams, 15 to 25 percent slopes.
Shapleigh-Gloucester very rocky sandy loams, 3 to 15 percent slopes.
Shapleigh-Gloucester very rocky sandy loams, 15 to 25 percent slopes.

Outcrops of bedrock are so numerous on these soils that cultivation is not practical. During dry periods plants are damaged by lack of moisture. These soils can be used for permanent pasture and for woodland. Trees, however, grow more slowly on these soils than on deeper soils.

CAPABILITY UNIT VIs-72

This capability unit consists of nearly level to sloping, very stony, deep, moderately well drained soils in glacial till. These soils are moderately coarse textured to medium textured and are loose to compact. Stones and boulders on these soils are so numerous that they interfere seriously with the use of farm machinery. These soils are—

Acton very stony fine sandy loam, 0 to 8 percent slopes.
Acton very stony fine sandy loam, 8 to 15 percent slopes.
Woodbridge very stony loam, 0 to 8 percent slopes.
Woodbridge very stony loam, 8 to 15 percent slopes.

These soils are suitable for permanent pasture and for woodland. Many areas of permanent pasture on these soils are gradually being replaced by pasture on other soils that can produce forage of higher quality. These stony areas are reverting to woodland in many places by natural reseeding. In some areas stones can be removed from the surface, and the soil can be used more intensively. Seeps are common on these soils amd may be suitable for developing as watering places for livestock.

CAPABILITY UNIT VIIw-14

In this capability unit are very poorly drained soils and land types on flood plains, and organic soils on uplands. These soils occupy nearly level areas, depressions, old oxbows, and sloughs and are developing in recent stream sediments. The soils on flood plains are very frequently flooded and are waterlogged most of the time by a high water table or by seepage. They are too wet to be worked with farm tractors.

Saco soils have a silty to sandy surface layer and a clayey to sandy subsoil. Mixed alluvial land contains water-sorted material that is so variable in texture and drainage, within short distances, that no specific soil description can be given. Muck and Peat are organic soils that occur in depressions on uplands, on sandy plains, and on flood plains. The depth of the organic material varies from 12 inches to 50 feet, but in most places, it is 3 feet or more. The soils and land types are—

Mixed alluvial land.
Muck and Peat.
Saco silt loam.

These soils and land types are too wet for crops and are generally used as wildlife habitats. Some areas are used as permanent pasture during dry periods. Frequent flooding and waterlogging limit use for other purposes. Artificial drainage is seldom possible because the surface of the soil and the stream have nearly the same elevation.

CAPABILITY UNIT VIIs-7

This capability unit consists of steeply sloping, very stony soils that developed in moderately coarse textured to medium textured glacial till. These are deep, well-drained soils that have loose to compact material below the subsoil. Steep slopes and many stones limit their use. The soils are—

Gloucester very stony sandy loam, 25 to 60 percent slopes.
Paxton very stony loam, 25 to 60 percent slopes.

The soils in this capability unit are suitable for woodland (fig. 7). Because of the steepness of the slopes, they can be used successfully only for trees. Beech, birch, maple, red oak, hemlock, red pine, and white pine grow well.

CAPABILITY UNIT VIIs-26

The only soil of this capability unit is Windsor loamy sand, 15 to 60 percent slopes. It is deep, droughty, and strongly sloping to very steep. This is a water-sorted, or wind-sorted sandy soil that has little or no gravel. It is generally on the steep edge of sandy terrace escarpments. Water moves very rapidly through the soil, and little is held for plant use. Many sand pits are on this soil.

Because the soil is extremely steep and sandy, its use is limited to woodland. It is too steep for the safe use of farm equipment. Gullies form if it is not protected by plants. The soil should not be pastured, as the protective cover would be destroyed or the surface punctured by the feet of animals.

CAPABILITY UNIT VIIs-27

This capability unit consists of strongly sloping to very steep, deep, excessively drained, very droughty, sandy and gravelly soils on terrace breaks and on eskers. These soils contain water-sorted sand and gravel and very little silt and clay. Water moves through them very rapidly

Figure 7.—**White pine is the most important species in the county. It is adapted to a wide range of soils.**

and little is held available for plants. The outstanding characteristics of these soils are their steepness and large content of sand and gravel. Many gravel pits are on these soils. The soils are—

Colton gravelly loamy sand, 15 to 60 percent slopes.
Hinckley gravelly loamy sand, 15 to 60 percent slopes.

Because these soils are extremely steep and gravelly, they are suitable only for trees. A protective cover is needed at all times to minimize erosion.

CAPABILITY UNIT VIIs-58

This capability unit consists of extremely stony, deep, well-drained soils and extremely rocky, very shallow, droughty soils. These are moderately coarse textured, moderately sloping to very steeply sloping soils in glacial till. The outstanding characteristics of the soils in this unit are their extreme stoniness and outcrops of bedrock. Stones are no more than a step apart in many places. The soils are—

Canaan-Hermon extremely rocky sandy loams, 8 to 25 percent slopes.
Canaan-Hermon extremely rocky sandy loams, 25 to 60 percent slopes.
Gloucester extremely stony sandy loam, 8 to 25 percent slopes.
Gloucester extremely stony sandy loam, 25 to 60 percent slopes.
Hermon extremely stony sandy loam, 8 to 25 percent slopes.
Hermon extremely stony sandy loam, 25 to 60 percent slopes.
Shapleigh-Gloucester extremely rocky sandy loams, 8 to 25 percent slopes.
Shapleigh-Gloucester extremely rocky sandy loams, 25 to 60 percent slopes.

Because they are extremely stony or rocky, these soils are best used for woodland. Logging is hindered by the large number of stones or boulders, and in many places it has to be done when the ground is covered with deep snow. Beech, birch, maple, oak, hemlock, and white pine grow on these soils. Trees grow more slowly on soils of the very shallow Canaan-Hermon and Shapleigh-Gloucester complexes than on the deep Hermon and Gloucester soils.

CAPABILITY UNIT VIIs-74

This capability unit consists of nearly level to gently sloping, poorly drained to very poorly drained, very stony loams in glacial till. These soils are saturated by a water table that is near the surface late in fall, in winter, and in spring. In Merrimack County, the Whitman soils have been mapped only in an undifferentiated group with Ridgebury soils because they are similar to these soils in characteristics and suitability for use. Any area of this group shown on the soil map may be all Ridgebury soils, or all Whitman soils, or have varying amounts of both. The soils are —

Ridgebury and Whitman very stony loams, 0 to 3 percent slopes.
Ridgebury and Whitman very stony loams, 3 to 8 percent slopes.

Stoniness and poor drainage restrict the use of these soils to permanent pasture or to woodland. Enough stones are on the surface to prevent the use of modern farm equipment. Waterlogging limits the kinds of plants that can be grown. This unit provides good sites for farm ponds (fig. 8). Logging roads through these soils are wet and soft except in winter when the soil is frozen and in summer when it is dry.

CAPABILITY UNIT VIIIw-89

This capability unit contains only Marsh. Marsh consists of areas that are covered with shallow water most of the time. It occurs mainly around the edge of lakes and ponds, but it is also in depressions where water stands a large part of the time.

Areas of Marsh have no value for cultivation, grazing, or forestry. They are very important habitats for wildlife, especially waterfowl. Drainage is not practical. Marsh may be developed for wildlife by building a structure to control or regulate the depth of water. These areas can be managed for waterfowl and for muskrat and other fur-bearing animals.

CAPABILITY UNIT VIIIs-90

This capability unit consists of land types that have little or no soil and are generally bare of vegetation. These areas have little or no agricultural value. The land types are—

Riverwash.
Rock outcrop.

Riverwash consists of a mixture of water-deposited sand, gravel, and cobbles on flood plains adjacent to streams. Some materials are moved frequently by swift currents. Trees may be planted on areas that have been undisturbed for a long period and where organic matter has accumulated. Some areas of Riverwash are a source of sand and gravel.

Rock outcrop consists of areas of bedrock that have little or no soil. It occurs on mountaintops, hilltops, and steep cliffs in the uplands. Some of these nonagricultural areas have value as recreational and scenic sites.

Figure 8.—**Farm pond on Ridgebury and Whitman soils provides water for irrigation and for livestock. Apple orchard in background near center.**

Estimated yields

The estimated long-term yields for the principal crops grown in Merrimack County are given in table 1 for specified soils under two levels of management. The yields listed under columns A are expected under the management that prevails in the county; those in columns B are expected under improved management. Absence of yield figure in the table indicates that the crop is not commonly grown, is not well suited to the soil, or cannot be feasibly grown under the level of management specified. Soils not shown in the table are considered too steep, too stony, too rocky, or too wet for the crops listed. In addition, the miscellaneous land types are not shown because their use is limited to nonagricultural purposes, or their properties are too variable to allow reliable estimates.

The yields shown are averages that can be expected over a period of several years. In any year, yields may be affected by several factors, such as favorable or unfavorable weather, plant diseases, or insects.

The estimates in columns A and columns B are based largely on (1) observations made by soil scientists during the survey and by members of the New Hampshire Agricultural Experiment Station; (2) records of farmers; and (3) records of other agricultural workers who are familiar with yields in the county. For most soils, however, records on specific crop yields were not available.

Under prevailing, or ordinary management, insufficient amounts of lime, fertilizer, and manure are used and on some farms, erosion control, drainage, and irrigation are inadequate. In addition, improved varieties, certified seed, and adequately prepared seedbeds are not always used, and insects and plant diseases are not well controlled. Also, some pastures are brushy, weedy, and unimproved.

Improved management of cropland includes (1) the application of enough lime, manure, and commercial fertilizer; (2) use of appropriate cropping systems and of crop residues; (3) drainage and irrigation if needed; (4) control of runoff, erosion, weeds, brush, insects, and plant diseases; (5) adequate preparation of seedbeds; and (6) selection of suitable crops and varieties. Improved management for pasture includes fertilizing, liming, controlling brush and weeds, seeding desirable forage plants, and regulating grazing.

TABLE 1—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are expected under prevailing management; those in columns B are expected under improved management. Absence of yield indicates crop is not commonly grown, is not well suited to the soil, or cannot be feasibly grown under the level of management specified. Very steep, stony, rocky, or extremely wet soils and miscellaneous land types have been omitted]

Soil	Corn for—				Mixed Hay				Oats		Potatoes		Tall grass-legume pasture	
	Grain		Silage [1]		Grass and clover		Alfalfa and grass							
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cow-acre-days* [2]	*Cow-acre-days* [2]
Acton fine sandy loam, 0 to 8 percent slopes	35	75	7	15	2	4	2	4	35	45	----	----	110	220
Agawam very fine sandy loam, 0 to 3 percent slopes	60	100	12	20	2	3	2	4	40	70	350	600	100	230
Agawam very fine sandy loam, 3 to 8 percent slopes	60	100	12	20	2	3	2	4	40	70	350	600	100	230
Au Gres fine sandy loam, 0 to 3 percent slopes	----	----	----	12	1	3	----	----	----	----	----	----	55	110
Au Gres fine sandy loam, 3 to 8 percent slopes	----	----	----	12	1	3	----	----	----	----	----	----	55	110
Au Gres loamy sand, 0 to 8 percent slopes	----	----	----	12	1	3	----	----	----	----	----	----	55	110
Belgrade silt loam, 0 to 8 percent slopes	35	75	7	15	2	4	2	3	35	45	----	----	110	220
Colton loamy sand, 0 to 3 percent slopes	----	----	----	9	.5	1	1	2	20	30	----	----	----	85
Colton loamy sand, 3 to 8 percent slopes	----	----	----	9	.5	1	1	2	20	30	----	----	----	85
Colton loamy sand, 8 to 15 percent slopes	----	----	----	9	.5	1	1	2	20	30	----	----	----	85
Duane fine sandy loam, 0 to 8 percent slopes	35	75	10	15	2	4	2.5	4	35	45	----	----	110	220
Gloucester sandy loam, 3 to 8 percent slopes	50	75	10	15	1.5	2.5	2.5	4	40	50	325	450	110	165
Gloucester sandy loam, 8 to 15 percent slopes	50	75	10	15	1.5	2.5	2.5	4	40	50	325	450	110	165
Gloucester sandy loam, 15 to 25 percent slopes	----	75	----	15	.5	1.5	1.5	3	----	----	----	----	110	165
Hermon sandy loam, 3 to 8 percent slopes	50	75	10	15	1.5	2.5	2.5	4	40	50	325	450	110	165
Hermon sandy loam, 8 to 15 percent slopes	50	75	10	15	1.5	2.5	2.5	4	40	50	325	450	110	165
Hermon sandy loam, 15 to 25 percent slopes	----	75	----	15	.5	2.5	1.5	3	----	----	----	----	110	165
Hinckley loamy sand, 0 to 3 percent slopes	----	----	----	9	.5	1	1	2	20	30	----	----	----	85
Hinckley loamy sand, 3 to 8 percent slopes	----	----	----	9	.5	1	1	2	20	30	----	----	----	85
Hinckley loamy sand, 8 to 15 percent slopes	----	----	----	9	.5	1	1	2	20	30	----	----	----	85
Limerick silt loam, high bottom	----	60	----	12	1	3	----	----	----	----	----	----	55	110
Merrimac sandy loam, 0 to 3 percent slopes	30	45	6	10	1	2	2	3	30	40	200	350	50	100
Merrimac sandy loam, 3 to 8 percent slopes	30	45	6	10	1	2	2	3	30	40	200	350	50	100
Merrimac sandy loam, 8 to 15 percent slopes	30	45	6	10	1	2	2	3	30	40	200	350	50	100
Ninigret very fine sandy loam, 0 to 3 percent slopes	50	75	10	15	2.5	4	2	4	35	45	----	----	110	220
Ondawa fine sandy loam	90	125	18	25	2	4	2.5	4	40	70	350	600	125	250
Ondawa fine sandy loam, high bottom	90	125	18	25	2	4	2.5	4	40	70	350	600	125	250
Paxton loam, 0 to 8 percent slopes	60	100	12	20	2.5	4.5	2.5	4.5	40	55	350	600	130	255
Paxton loam, 8 to 15 percent slopes	60	100	12	20	2.5	4.5	2.5	4.5	40	55	350	600	130	255
Paxton loam, 15 to 25 percent slopes	----	100	----	20	1.5	3.5	1.5	3.5	----	----	----	----	130	255
Podunk fine sandy loam	50	75	10	15	2.5	4	2	4	40	50	----	----	110	220
Ridgebury loam, 0 to 3 percent slopes	----	60	----	12	1	3	----	----	----	----	----	----	55	110
Ridgebury loam, 3 to 8 percent slopes	----	60	----	12	1	3	----	----	----	----	----	----	55	110
Rumney fine sandy loam	----	60	----	12	1	3	----	----	----	----	----	----	55	110
Scarboro fine sandy loam	----	----	----	----	1	2	----	----	----	----	----	----	50	100
Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes	30	50	6	10	1.5	2.5	1.5	2.5	25	35	----	----	55	110
Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes	30	50	6	10	1.5	2.5	1.5	2.5	25	35	----	----	55	110
Sudbury fine sandy loam, 0 to 3 percent slopes	35	75	10	15	2	4	2.5	4	35	45	----	----	110	220
Sudbury fine sandy loam, 3 to 8 percent slopes	35	75	10	15	2	4	2.5	4	35	45	----	----	110	220
Suncook loamy sand	----	----	4	10	1	2	1	2	20	30	----	----	50	100
Windsor loamy sand, 0 to 3 percent slopes	----	----	4	10	1	2	1	2	20	30	----	----	50	100
Windsor loamy sand, 3 to 8 percent slopes	----	----	4	10	1	2	1	2	20	30	----	----	50	100
Windsor loamy sand, 8 to 15 percent slopes	----	----	4	10	1	2	1	2	20	30	----	----	50	100
Woodbridge loam, 0 to 8 percent slopes	50	75	10	15	2.5	4	2	4	40	50	----	----	110	220
Woodbridge loam, 8 to 15 percent slopes	50	75	10	15	2.5	4	2	4	40	50	----	----	110	220

[1] Estimates are for green weight.

[2] Cow-acre-days is a term used to express the number of days one acre will support one animal unit (1 cow, steer, or horse; 5 hogs; or 7 sheep or goats) without injury to the pasture.

Use of Soils as Woodland

Woodlands in Merrimack County [1]

In Merrimack County about 4 out of every 5 acres are forested. The proportion of forested acreage is less along the Merrimack River and more in the western and northern parts of the county. Areas listed as commercial forest make up 480,200 acres. There is a small acreage of noncommercial woodland.

The Society of American Foresters recognizes three general forest vegetation zones in this county (*11*).[2] The zones are (1) Transition Hardwood-White Pine-Hemlock Zone; (2) Northern Hardwood-Hemlock-White Pine Zone; and (3) Spruce-Fir-Northern Hardwood Zone.

The Transition Hardwood-White Pine-Hemlock Zone occupies 70 percent of the county. It covers the central and eastern parts, or the area of lower elevation. The trees in this zone are sugar maple, beech, white pine, hemlock, northern red oak, yellow birch, red pine, paper birch, aspen, gray birch, red maple, balsam fir, white oak, white ash, basswood, and hickory. This area used to be called the White Pine Region. Trees common in zones both to the north and to the south, however, are common in this area.

The Northern Hardwood-Hemlock-White Pine Zone, covering 20 percent of the county, is in the western part, generally at a higher elevation than the transition forest. Beech, sugar maple, red maple, and yellow birch are the main trees. White pine and hemlock are characteristic softwoods; scattered spruce and balsam fir occur. Red oak, white ash, paper birch, elm, and basswood also are common.

The Spruce-Fir-Northern Hardwood Zone makes up the remaining 10 percent in the county, and it is on the high hills and mountains in the western part. The species are red spruce, beech, sugar maple, yellow birch, paper birch, red maple, white pine, hemlock, and aspen.

Because the three zones just described merge into each other, they are generalized groupings. Small areas characteristic of each zone are scattered through the county.

The woodlands of the county are generally in poor condition. There are too few of the preferred commercial species and too many of the low-value species and individual trees. Because of the overcutting of the commercial softwood trees, many of the present stands are mixed or consist entirely of red maple, gray birch, and pin cherry. Similar trees have invaded many recently abandoned cultivated fields and pastures.

In 1948 a forest survey by the Northeastern Forest Experiment Station classified the commercial forest as follows: Sawtimber, 42 percent; pole timber, 30 percent; saplings and seedlings, 15 percent; and poorly stocked, 13 percent. A very large part of the sawtimber is under 16 to 18 inches in diameter at breast height (d.b.h.). Few trees larger than 16 to 18 inches are among the commercial species. Statewide studies show that two-thirds of the growing stock is under 12 inches in diameter at breast height.

The original forests were mixed hardwoods and softwoods. They consisted of sugar maple, beech, hemlock, and other shade-tolerant trees mixed with chestnut, oak, and pine. On the higher elevations were mainly spruce and fir.

There is evidence that at the time of settlement the forests were not all old, undisturbed groves but were trees of mixed ages. Forest fires started by lightning and by Indians to improve hunting destroyed the trees in large areas. Also, wind from local tornadoes and from hurricanes blew down single trees and occasionally entire stands. These disasters provided openings where aspen, paper birch, pin cherry, and other pioneer species could invade. Pure stands of white or red pine may have been established under these conditions.

When the area was settled by Europeans, the clearing of the original forest was necessary to provide cropland. Some trees, particularly white pines, were sawed or hewn into timber for export, but most of the trees were burned.

The expansion of the settlements and the change in agriculture from subsistence farming to the production of grain, wool, and beef for export led to increased destruction of the forests. Between 1825 and 1850 the acreage of woodland in Merrimack County was reduced to less than one-half of the total land area. After the railroads were built, the remaining woodlands were heavily cut to provide fuel for the trains. Similarly, the increase in the size of cities south of the county and the industrial expansion created a demand for timber used in construction.

As a result of western migration, shifts of the population to manufacturing centers, and soil depletion that began in the 1850's, the less productive hill farms were abandoned. This abandoned farmland was first used for pasture. Grazing controlled the reproduction of hardwoods but encouraged the development of pure stands of even-aged softwoods. These softwoods provided timber for the steam-powered, portable sawmills, which reached their maximum production about the end of the 19th century.

Because of the improvement in equipment and highways, stationary sawmills and the small woodlots are again being operated. Depletion of woodland by cutting during two world wars and by a hurricane in 1938 has greatly reduced the amount of sawtimber.

For the past 100 years, loggers have cut the softwoods and have left the average and lower grade hardwoods. Thus the woodland is reverting to the less valuable species of the precolonial forest. Land abandonment is continuing, but new owners are interested in woodland conservation and in improved management of woodland.

In Merrimack County from 30 to 50 million board feet of lumber is cut annually; the stumpage volume is as much as half a million dollars. Increases in the value of lumber because of manufacturing and of allied service could raise the annual value of the wood industry to $5 million. The value of woodland for recreation and water protection is not included in this estimate, but it adds much to the economy of the county.

[1] Extent of forest and type of forest supplied by WILBUR E. THOMPSON, county forester, Merrimack County Cooperative Extension Service.

[2] Italic numbers in parentheses refer to Literature Cited, page 92.

Woodland suitability groupings of soils

The soils of the county have been placed in nine woodland suitability groups so that owners can plan the management of woodland. These groups are listed in table 2 and are described in the text. Each group is made up of soils that have comparable potential productivity for trees and that need similar management. For each suitability group, ratings are given to indicate their productive capacity, limitations, and hazards for woodland use.

Soils, climate, and topography all affect tree growth. The soils of the county differ greatly in their ability to grow trees. They vary in their capacity to supply plant nutrients and water and in such characteristics as depth, texture, parent material, and drainage. The amount of rain, snow, and ice; temperature changes; and the amount of sunshine also influence tree growth. The combination of the factors that affect tree growth is expressed as site index, which is the average height of the dominant or codominant trees at 50 years of age. Field studies in the county and elsewhere were made to determine the site index of representative soils for white pine, red spruce, and sugar maple.

In table 2 the productivity of each group for white pine, red spruce, and sugar maple is given by site class. The site class is a grouping of soils within a defined range of site indexes. The range of the site index within each site class as used in table 2 is listed in the following summary. For white pine, soils with a site index of 70 or more are in site class I; soils with a site index of 60 to 69 are in site class II; soils with a site index of 50 to 59 are in site class III; and soils with a site index of 49 or less are in site class IV. For red spruce and sugar maple, soils with a site index of 59 or more are in site class I; soils with a site index of 53 to 58 are in site class II; soils with a site index of 45 to 52 are in site class III; and soils with a site index of 44 or less are in site class IV. Site classes have been estimated for the soils on which no data have been collected by comparing them with similar soils on which studies have been made.

As shown in table 2, each woodland suitability group has, in varying degree, limitations that affect its management. Some of these limitations are expressed in relative terms, *slight, moderate,* or *severe.* The relative term expresses the degree of limitation, as explained in the following:

PLANT COMPETITION: When openings are made in the canopy, undesirable brush, trees, and plants may invade. The invading growth competes with the desirable trees and hinders their establishment and growth.

Competition is *slight* if unwanted plants are no special problem. It is *moderate* if the invaders delay but do not prevent the establishment of a normal, adequate stand. Competition is *severe* if desirable trees cannot regenerate naturally.

EQUIPMENT LIMITATION: Ratings for limitations are on the basis of natural wetness that hinders the use of ordinary equipment in woodland operations.

Limitation is *slight* if the soils have good drainage and there are no restrictions on the kind of equipment or on the time of year that the equipment can be used. It is *moderate* if heavy equipment is restricted by wetness for a period less than 3 months each year. Equipment limitation is *severe* if swampy conditions restrict the use of equipment for a period longer than 3 months a year. A severe rating generally means that logging is easiest when the soil is frozen. Steepness of slope, the number and amount of stones on the surface, and rock outcrops were not considered in making these ratings. Numerous outcrops and large boulders, however, may severely hinder logging except in winter when the snow is deep. This condition applies especially to the Canaan-Hermon and the Shapleigh-Gloucester soil complexes. On slopes of less than about 8 percent, farmers or commercial operators have little difficulty in logging or in building roads. On slopes of 8 to 25 percent, commercial operators have few problems in logging or in building roads, but farmers have some difficulty. On slopes of 25 to 60 percent, logging and the building and maintaining of roads are serious problems.

SEEDLING MORTALITY: Even when healthy seedlings of a suitable tree are correctly planted or occur naturally in adequate numbers, some of them will not survive if characteristics of the soil are unfavorable. Drainage, texture, and depth of soil were the characteristics used as a basis for rating mortality.

Mortality is *slight* if trees ordinarily regenerate naturally in places where there are enough seed. It is *moderate* if trees do not always regenerate naturally in numbers needed for adequate restocking. Mortality is *severe* if natural reseeding cannot be relied upon, considerable replanting is likely to be needed, and a special seedbed must be prepared.

WINDTHROW HAZARD: This hazard is related to soil characteristics that affect the development of tree roots. Such characteristics are a high water table or shallowness to bedrock or another impervious layer. Except for trees that have a naturally shallow root system, these characteristics were considered in making the ratings for windthrow hazard.

The windthrow hazard is *slight* if roots hold the tree firmly against a normal wind. The hazard is *moderate* if root development is limited to a depth of 18 inches by a high water table, a pan layer, or bedrock. The hazard is *severe* if root development is limited to about 10 inches by a high water table, a pan layer, or bedrock.

Also in table 2, the desirable tree species are listed and their suitability for planting is rated for the soils comprising each woodland suitability group.

Except for the site classes for white pine, all the ratings in table 2 were made on the basis of the experience and judgment of foresters of the New Hampshire Department of Resource and Economic Development in cooperation with soil scientists of the Soil Conservation Service.

The estimated annual growth and yield of white pine per acre for each site class is given in table 3. These data can be used to estimate the growth and yield of white pine for each of the woodland suitability groups.

TABLE 2.—*Estimated site classes, limitations, and planting*

Woodland suitability group and mapping symbol	Estimated site class for—			Limitations		
				Plant competition		
	White pine	Red spruce	Sugar maple	White pine	Red spruce	Sugar maple
Group 1: Deep, loamy, moist soils in glacial till (AcB, AdB, AdC, WoB, WoC, WvB, WvC).	I	I	I	Severe	Moderate	Slight
Group 2: Deep, well-drained and moderately well drained, loamy soils on uplands, outwash, and flood plains and in glacial lake beds and glacial till (AfA, AfB, BcB, DuB, NnA, Of, Oh, PaB, PaC, PaD, PnB, PnC, PnD, PnE, Po, SuA, SuB).	II	II	II	Moderate	Moderate	Slight
Group 3: Poorly drained and very poorly drained soils in sandy outwash and in loamy glacial till (AgA, AgB, AuB, RbA, RbB, RdA, RdB).	II	II	III	Severe	Moderate	Severe
Group 4: Deep, well-drained sandy soils in glacial till (GcB, GcC, GcD, GrB, GrC, GrD, GrE, GsD, GsE, HmB, HmC, HmD, HnB, HnC, HnD, HoD, HoE).	II	II	II	Moderate	Moderate	Moderate
Group 5: Deep, sandy and gravelly soils on flood plains, outwash, kames, and eskers (CoA, CoB, CoC, CtE, HrE, HsA, HsB, HsC, MmA, MmB, MmC, Sy, WdA, WdB, WdC, WdE).	II	III	III	Slight	Moderate	Moderate
Group 6: Soils that are shallow to bedrock and have a few outcrops (CaC, CaD, SgB, SgC, ShC, ShD).	III	II	II	Moderate	Moderate	Moderate
Group 7: Poorly drained soils in silty and clayey deposits and on flood plains and very poorly drained soils on outwash plains (Lm, Ru, Sc).	III	III	IV	Severe	Severe	Severe
Group 8: Soils that are extremely shallow to bedrock and have many outcrops (ChD, ChE, SoD, SoE).	III	II	II	Moderate	Moderate	Moderate
Group 9: Organic soils and very poorly drained soils on flood plains (Mp, Sa).	IV	IV	(3)	Severe	Severe	(3)

[1] Planting suitability for red pine is good on the Agawam and Ondawa soils. [2] Seedling mortality for sugar maple is severe.

On the following pages the nine woodland suitability groups of this county are described, and the soils in each group are listed.

Because they are variable and not enough data were available, the following land types were not placed in a woodland suitability group:

(Gv) Gravel pits.
(Ma) Made land.
(Mh) Marsh.
(Mn) Mixed alluvial land.
(Rh) Riverwash.
(Ro) Rock outcrop.

TABLE 3.—*Growth and yield per acre of white pine for fully stocked, unmanaged stand at 50 years of age* [1]

Site class	Site index	Average total volume		Average annual growth	
	Feet	*Cords*	*Board feet*	*Cords*	*Board feet*
I	70 or more	100	50, 000	2. 0	1, 000
II	60 to 69	72	36, 500	1. 44	720
III	50 to 59	48	24, 000	. 96	480
IV	49 or less	28	14, 000	. 56	280

[1] Adapted from data from U.S. Department of Agriculture (*3*).

WOODLAND SUITABILITY GROUP 1

This group consists of deep, moderately well drained soils in glacial till. The texture of the surface layer ranges from sandy loam to loam. The soils are—

Acton fine sandy loam, 0 to 8 percent slopes.
Acton very stony fine sandy loam, 0 to 8 percent slopes.
Acton very stony fine sandy loam, 8 to 15 percent slopes.
Woodbridge loam, 0 to 8 percent slopes.
Woodbridge loam, 8 to 15 percent slopes.
Woodbridge very stony loam, 0 to 8 percent slopes.
Woodbridge very stony loam, 8 to 15 percent slopes.

These are the most productive soils in the county for trees (fig. 9). They supply adequate moisture for trees, and are in site class I for white pine, red spruce, and sugar maple. White pine, however, receives severe competition from hardwoods, and requires weeding, release cutting, and other special attention to survive. Competition for red spruce is moderate, and for sugar maple it is slight. Seedling mortality for the three species is slight. Even though these soils are only moderately well drained, equipment limitation caused by natural drainage is not serious. During spring thaws and after wet periods, logging may be delayed for a short time until the soil dries out. Suitability for planting is good for all trees listed in table 2 except red pine. It is fair for this tree.

suitability for woodland suitability groups of soils

Limitations—Continued			Planting suitability for—				
Equipment limitations due to natural drainage	Seedling mortality for white pine, red spruce, and sugar maple	Windthrow hazard	White pine	Red pine	White spruce	Balsam fir	European larch
Moderate	Slight	Slight	Good	Fair	Good	Good	Good.
Moderate	Slight	Slight	Good	Fair [1]	Good	Good	Good.
Severe	Moderate [2]	Severe	Good	Not suitable	Good	Good	Poor.
Slight	Slight	Slight	Good	Good	Fair	Fair to poor	Good.
Slight	Moderate	Slight	Good	Good	Poor	Poor	Fair.
Slight	Moderate	Moderate	Fair	Fair	Fair	Fair	Fair.
Severe	Severe	Severe	Poor	Not suitable	Fair	Fair	Not suitable.
Slight	Moderate	Severe	Fair	Poor	Fair	Poor	Fair.
Severe	Severe	Severe	Poor	Not suitable	Poor	Poor	Not suitable.

[3] Because sugar maple does not grow on these soils, it is not assigned to a site class and is not rated for plant competition.

WOODLAND SUITABILITY GROUP 2

This group consists of deep, well-drained and moderately well drained soils on flood plains, on outwash, in glacial lakebeds, and in glacial till. The soils are—

- Agawam very fine sandy loam, 0 to 3 percent slopes.
- Agawam very fine sandy loam, 3 to 8 percent slopes.
- Belgrade silt loam, 0 to 8 percent slopes.
- Duane fine sandy loam, 0 to 8 percent slopes.
- Ninigret very fine sandy loam, 0 to 3 percent slopes.
- Ondawa fine sandy loam.
- Ondawa fine sandy loam, high bottom.
- Paxton loam, 0 to 8 percent slopes.
- Paxton loam, 8 to 15 percent slopes.
- Paxton loam, 15 to 25 percent slopes.
- Paxton very stony loam, 3 to 8 percent slopes.
- Paxton very stony loam, 8 to 15 percent slopes.
- Paxton very stony loam, 15 to 25 percent slopes.
- Paxton very stony loam, 25 to 60 percent slopes.
- Podunk fine sandy loam.
- Sudbury fine sandy loam, 0 to 3 percent slopes.
- Sudbury fine sandy loam, 3 to 8 percent slopes.

All the soils in this group are in site class II for white pine, red spruce, and sugar maple. Suitability of the soils of this group for planting of white pine, white spruce, balsam fir, and European larch is good. It is fair for red pine on all the soils in the group except the Agawam and Ondawa soils. Suitability for planting red pine is good on these well-drained sandy soils in flood plains and adjacent stream terraces.

Plant competition is moderate for white pine and red spruce; it is slight for sugar maple. The equipment limitation is moderate. Seedling mortality and the windthrow hazard are slight.

WOODLAND SUITABILITY GROUP 3

In this group are poorly drained and very poorly drained soils in sandy outwash and in loamy glacial till. The soils are—

- Au Gres fine sandy loam, 0 to 3 percent slopes.
- Au Gres fine sandy loam, 3 to 8 percent slopes.
- Au Gres loamy sand, 0 to 8 percent slopes.
- Ridgebury loam, 0 to 3 percent slopes.
- Ridgebury loam, 3 to 8 percent slopes.
- Ridgebury and Whitman very stony loams, 0 to 3 percent slopes.
- Ridgebury and Whitman very stony loams, 3 to 8 percent slopes.

These soils have a fluctuating water table that is near or at the surface in wet periods and slightly lower in normal periods. For white pine and red spruce, the soils are in site class II; for sugar maple, they are in site class III. The soils are too wet for northern hardwoods.

Figure 9.—**Stand of pine on soils in woodland suitability group 1. Trees marked will be removed to thin stand and promote growth of desired trees.**

All the soils in this group are poorly drained except the Whitman soils, which are very poorly drained. The Ridgebury and Whitman very stony loams are mapped together as an undifferentiated unit. The Whitman soils occupy small stony, swampy, depressional areas, and are generally one site class lower than the rating given. The windthrow hazard of these soils is severe. Seedling mortality for sugar maple is severe; for white pine and red spruce it is moderate.

White pine may have severe competition from red maple and elm, and intensive release cutting and weeding may be needed to reduce competition with these hardwoods. Northern hardwoods seldom grow on these soils. The equipment limitation caused by natural drainage is severe. Logging is hindered for long periods because of wet soil, and many times must be done when the soil is frozen.

Red pine is not suitable for planting on these wet soils; for other trees listed in table 2, suitability is good, except for European larch. It is poor for this tree.

WOODLAND SUITABILITY GROUP 4

This group consists of deep, well-drained, sandy soils in glacial till. They occur in hilly and mountainous areas. The soils are—

- Gloucester sandy loam, 3 to 8 percent slopes.
- Gloucester sandy loam, 8 to 15 percent slopes.
- Gloucester sandy loam, 15 to 25 percent slopes.
- Gloucester very stony sandy loam, 3 to 8 percent slopes.
- Gloucester very stony sandy loam, 8 to 15 percent slopes.
- Gloucester very stony sandy loam, 15 to 25 percent slopes.
- Gloucester very stony sandy loam, 25 to 60 percent slopes.
- Gloucester extremely stony sandy loam, 8 to 25 percent slopes.
- Gloucester extremely stony sandy loam, 25 to 60 percent slopes.
- Hermon sandy loam, 3 to 8 percent slopes.
- Hermon sandy loam, 8 to 15 percent slopes.
- Hermon sandy loam, 15 to 25 percent slopes.
- Hermon very stony sandy loam, 3 to 8 percent slopes.
- Hermon very stony sandy loam, 8 to 15 percent slopes.
- Hermon very stony sandy loam, 15 to 25 percent slopes.
- Hermon extremely stony sandy loam, 8 to 25 percent slopes.
- Hermon extremely stony sandy loam, 25 to 60 percent slopes.

All the soils in this group are in site class II for white pine, sugar maple, and red spruce. Plant competition is moderate for these species because moisture is lacking in dry periods and hardwoods do not compete severely. Seedling mortality and the windthrow hazard are slight. Although the equipment limitation caused by natural drainage is slight, the extremely stony soils in this group generally have many stones and boulders on the surface that hinder logging.

Balsam fir has fair to poor suitability for planting because the soils are sandy and tend to be droughty. The Hermon soils are better suited to balsam fir than the Gloucester soils. Suitability of white spruce is fair, and suitability for white pine, red pine, and European larch is good.

WOODLAND SUITABILITY GROUP 5

In this group are deep, sandy soils and sandy soils underlain by gravel on flood plains, outwash, kames, and eskers. Water moves very rapidly through these soils. The soils are—

- Colton gravelly loamy sand, 15 to 60 percent slopes.
- Colton loamy sand, 0 to 3 percent slopes.
- Colton loamy sand, 3 to 8 percent slopes.
- Colton loamy sand, 8 to 15 percent slopes.
- Hinckley gravelly loamy sand, 15 to 60 percent slopes.
- Hinckley loamy sand, 0 to 3 percent slopes.
- Hinckley loamy sand, 3 to 8 percent slopes.
- Hinckley loamy sand, 8 to 15 percent slopes.
- Merrimac sandy loam, 0 to 3 percent slopes.
- Merrimac sandy loam, 3 to 8 percent slopes.
- Merrimac sandy loam, 8 to 15 percent slopes.
- Suncook loamy sand.
- Windsor loamy sand, 0 to 3 percent slopes.
- Windsor loamy sand, 3 to 8 percent slopes.
- Windsor loamy sand, 8 to 15 percent slopes.
- Windsor loamy sand, 15 to 60 percent slopes.

The Suncook and Windsor soils are deep and very sandy. The Colton, Hinckley, and Merrimac soils are sandy but are underlain by gravel. The Merrimac soils hold moisture better than other soils in this group.

All soils in this group are in site class II for white pine. For red spruce and sugar maple all soils are in site class III. Red spruce and sugar maple, however, rarely occur, as these soils are droughty. In places red spruce occurs on the Colton soils. Plant competition is slight for white pine; for red spruce and sugar maple, it is moderate. The equipment limitation is slight because logging can be done any time, and roads through woodlands are easily built on these dry, sandy and gravelly soils.

Seedling mortality for this group is moderate except on the Hinckley soils. Because the Hinckley soils are droughty, mortality is severe. Suitability for planting the species listed in table 2 is fair for all soils in this group.

WOODLAND SUITABILITY GROUP 6

In this group are soils on uplands that are shallow to bedrock. In most places bedrock is within 24 inches of the surface, and in some places it crops out. The shallow soils tend to be droughty. The soils are—

- Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes.
- Canaan-Hermon very rocky sandy loams, 15 to 25 percent slopes.
- Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes.
- Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes.
- Shapleigh-Gloucester very rocky sandy loams, 3 to 15 percent slopes.
- Shapleigh-Gloucester very rocky sandy loams, 15 to 25 percent slopes.

White pine is in site class III; red spruce and sugar maple are in site class II. Plant competition and seedling mortality are moderate for these species. The equipment limitation is slight. The windthrow hazard is moderate for these soils, but if the stand is opened by heavy cutting the hazard is increased. The suitability of these soils for planting is fair for all species listed in table 2.

WOODLAND SUITABILITY GROUP 7

In this group are poorly drained and very poorly drained soils in silty and clayey deposits, on flood plains, and in depressions on outwash plains. The soils are—

Limerick silt loam, high bottom.
Rumney fine sandy loam.
Scarboro fine sandy loam.

The Limerick soils have a fluctuating water table. The Scarboro soils are saturated most of the time. The Rumney soils are on low flood plains that have a high water table and are flooded during periods of high water.

For white pine and red spruce, the soils in this group are in site class III; for sugar maple, they are in site class IV, though this tree rarely occurs on these soils.

Plant competition for white pine and red spruce is severe from red maple and elm, which grow vigorously on these poorly drained soils. Equipment limitation due to natural drainage is severe. Logging is hindered for long periods by wetness. Often it is necessary to harvest the trees when the soil is frozen. Seedling mortality for white pine, red spruce, and sugar maple is severe on the soils of this group. The windthrow hazard is severe because the high water table restricts the depth of tree roots.

Red pine and European larch are not suitable for planting on these soils. Suitability for planting white pine is poor; it is fair for white spruce and balsam fir.

WOODLAND SUITABILITY GROUP 8

The soils in this group are extremely shallow to bedrock. They occur in the rough, hilly and mountainous areas. Depth to bedrock is generally less than 20 inches, and rock outcrops are common. These soils are droughty and provide little moisture for trees. The soils are—

Canaan-Hermon extremely rocky sandy loams, 8 to 25 percent slopes.
Canaan-Hermon extremely rocky sandy loams, 25 to 60 percent slopes.
Shapleigh-Gloucester extremely rocky sandy loams, 8 to 25 percent slopes.
Shapleigh-Gloucester extremely rocky sandy loams, 25 to 60 percent slopes.

White pine is in site class III; red spruce and sugar maple are in site class II. Trees grow slowly on these extremely shallow soils. Plant competition is moderate for white pine, red spruce, and sugar maple.

Seedling mortality is moderate on these droughty soils. The windthrow hazard is severe because of the thin root zone over bedrock. The equipment limitation is slight. The suitability for planting the trees listed in table 2 is fair to poor because these soils are extremely shallow and droughty.

WOODLAND SUITABILITY GROUP 9

In this group are highly organic soils and very poorly drained soils on flood plains. The soils are—

Muck and Peat.
Saco silt loam.

A high water table is at the surface of these soils most of the time. Muck and Peat soils are ponded in wet seasons; Saco soils are flooded during periods of high water.

Soils of this group are in site class IV for white pine and red spruce. Sugar maple is not assigned to a site class because it does not grow on these soils. Plant competition is severe from a dense cover of low-growing grasses, sedges, and brush. Trees rarely grow on these soils.

Seedling mortality is severe. Logging equipment is seldom needed, but the limitation is severe. Suitability is poor for planting white pine, white spruce, and balsam fir. Red pine and European larch are not suitable for these soils.

Use of Soils for Wildlife[3]

This section consists of two main parts. In the first part, the present food, cover, and kinds of wildlife (*6*) in the soil associations, as shown on the general soil map, are discussed. In the second part, specific information is given about the suitability of the soils for the establishment, improvement, or maintenance of particular kinds of wildlife habitats. Also, table 4, showing the suitability rating of the soils for wildlife habitats is included.

Soil associations 1 and 2

These associations are in the northern and western parts of the county and are mainly steep, hilly, and mountainous. Hermon, Canaan, and Colton are the principal soils on the uplands. The sandy and gravelly Colton and Rumney soils are on the wet flood plains.

Most areas of these associations are now forested, and little farming is done. Northern hardwoods mainly beech, sugar maple, red maple, and yellow birch predominate, but there is some white pine and hemlock. Red oak, black cherry, poplar, white birch, gray birch, white ash, and basswood also occur. Many shrubs and small trees that produce important food and cover for wildlife are in woodlands, especially those heavily cut over, and they are common also in abandoned fields. Among these trees and shrubs are thornapple, wild apple, chokecherry, pin cherry, viburnum, dogwood, and raspberry in the drier areas and alder and willow in the wetter areas. Striped maple, mountain maple, mountain ash, hornbeam, hophornbeam, and Canada yew are common small trees and shrubs of the thicker woodlands. At the highest elevations, a spruce-fir forest predominates; low blueberries and other shrubs generally grow on the most rocky areas.

The most important kinds of wildlife in associations 1 and 2 and their habitats are discussed in the following paragraphs

Deer.—The more mountainous areas, where timber has not been cut extensively in recent years, are generally poor habitats for deer. The hilly parts, particularly areas where timber has been cut more recently and where abandoned fields and pastures are partly covered with shrubs and saplings, are better. A few areas of grassland and cropland provide spring and summer food. Alder and willow swamps provide good habitats. The mountainous areas are limited in use for deer by deep snow. The spruce-fir woodlands are also poor habitats.

[3] This section was prepared by PHILIP F. ALLAN, biologist, Soil Conservation Service.

TABLE 4.—*Suitability of the soils for wildlife habitats and kind of wildlife*

[Soils rated 1 are well suited; 2, suited; 3, poorly suited; and 4, unsuited]

Soil series and map symbols [1]	Kind of habitat								Kind of wildlife		
	Grain and seed crop	Grass and legume	Wild herbaceous upland plant	Hardwood woodland plant	Coniferous woodland plant	Wetland plant	Shallow water	Excavated pond	Openland wildlife	Woodland wildlife	Wetland wildlife
Acton:											
AcB	2	1	1	2	3	4	4	4	1	2	4
AdB, AdC	4	3	1	2	3	4	4	4	4	2	4
Agawam:											
AfA	1	1	1	1	3	4	4	4	1	1	4
AfB	2	1	1	1	3	4	4	4	1	1	4
Au Gres:											
AgA	3	2	2	1	2	1	1	1	2	1	1
AgB, AuB	3	2	2	1	2	4	4	4	2	1	4
Belgrade:											
BcB	2	1	1	1	3	4	4	4	1	1	4
Canaan-Hermon:											
CaC, CaD, ChD, ChE	4	4	3	3	1	4	4	4	4	3	4
Colton:											
CoA, CoB, CoC	3	3	3	3	2	4	4	4	3	3	4
CtE	4	4	3	3	2	4	4	4	4	3	4
Duane:											
DuB	2	1	1	1	3	4	4	4	1	1	4
Gloucester:											
GcB, GcC	2	1	1	2	3	4	4	4	1	2	4
GcD	3	2	1	2	3	4	4	4	2	2	4
GrB, GrC, GrD	4	3	1	2	2	4	4	4	3	2	4
GrE	4	4	1	2	2	4	4	4	3	2	4
GsD, GsE	4	4	3	2	1	4	4	4	4	2	4
Hermon:											
HmB, HmC	2	1	1	2	3	4	4	4	1	2	4
HmD	3	2	1	2	3	4	4	4	2	2	4
HnB, HnC, HnD	4	3	1	2	2	4	4	4	3	2	4
HoD, HoE	4	4	3	2	1	4	4	4	4	2	4
Hinckley:											
HrE	4	4	3	3	2	4	4	4	4	3	4
HsA, HsB, HsC	3	3	3	3	2	4	4	4	3	3	4
Limerick:											
Lm	3	2	2	1	2	1	1	1	2	1	1
Marsh:											
Mh	4	4	4	4	4	1	1	4	4	4	1
Merrimac:											
MmA, MmB, MmC	2	1	2	2	2	4	4	4	1	2	4
Muck and Peat:											
Mp	4	3	4	4	1	2	1	1	4	3	1
Ninigret:											
NnA	2	1	1	1	3	3	3	3	1	1	3
Ondawa:											
Of	2	1	1	1	3	3	3	3	1	1	3
Oh	1	1	1	1	3	4	4	4	1	1	4
Paxton loam:											
PaB, PaC	2	1	1	1	3	4	4	4	1	1	4
PaD	3	2	1	1	3	4	4	4	2	1	4
PnB, PnC, PnD, PnE	4	3	1	1	2	4	4	4	3	1	4

See footnote at end of table.

TABLE 4.—*Suitability of the soils for wildlife habitats and kind of wildlife*—Continued

[Soils rated 1 are well suited; 2, suited; 3, poorly suited; and 4, unsuited]

Soil series and map symbols [1]	Kind of habitat								Kind of wildlife		
	Grain and seed crop	Grass and legume	Wild herbaceous upland plant	Hardwood woodland plant	Coniferous woodland plsnt	Wetland plant	Shallow water	Excavated pond	Openland wildlife	Woodland wildlife	Wetland wildlife
Podunk:											
Po	4	3	3	1	1	1	4	4	3	1	3
Ridgebury:											
RbA	3	2	2	1	2	1	1	1	2	1	1
RbB	3	2	2	1	2	3	4	4	2	1	4
Ridgebury and Whitman:											
RdA	4	3	3	1	1	1	2	2	3	1	1
RdB	4	3	3	1	1	3	4	4	3	1	4
Rumney:											
Ru	3	2	2	1	2	2	3	4	2	1	3
Saco:											
Sa	4	3	3	1	1	1	4	4	3	1	3
Scarboro											
Sc	4	3	3	1	1	1	1	1	3	1	1
Shapleigh-Gloucester:											
SgB	3	2	2	2	2	4	4	4	2	2	4
SgC	4	3	3	3	1	4	4	4	4	3	4
ShC, ShD, SoD	4	4	3	3	1	4	4	4	4	3	4
SoE	4	4	4	3	1	4	4	4	4	3	4
Sudbury:											
SuA	2	1	1	1	3	3	3	3	1	1	3
SuB	2	1	1	1	3	4	4	4	1	1	4
Suncook:											
Sy	3	3	3	3	2	4	4	4	3	3	4
Windsor:											
WdA, WdB, WdC	3	3	3	3	2	4	4	4	3	3	4
WdE	4	4	3	3	2	4	4	4	4	3	4
Woodbridge:											
WoB, WoC	2	1	1	1	3	4	4	4	1	1	4
WvB, WvC	4	3	1	1	2	4	4	4	3	1	4

[1] Gravel pits, Riverwash, and Rock outcrop do not provide a suitable habitat and are not rated; Made land and Mixed alluvial land are not rated because they are too variable.

Snowshoe hares.—Newly cutover areas, especially those having many small conifer, gray birch, sumac, and poplar saplings and raspberry briers provide the best habitats for snowshoe hares. These animals also frequent alder and willow swamps. Snowshoe hares generally are scarce in the older forests and, therefore, they are not found in large numbers in the more mountainous areas. The spruce-fir woodlands often support a large population of snowshoe hares. Snow is not a serious limitation to hares. Because of their ability to travel in very deep snow, they are often able to reach browse unavailable to deer. The snowshoe hare population, however, fluctuates at intervals, regardless of the suitability of the habitats.

Ruffed grouse.—Although they are woodland birds, the ruffed grouse are numerous principally where there are many openings in the forest. Clearings, overgrown fields and pastures, swampy areas, and roadsides provide good habitats. Although conifers are of some importance, extensive stands of pole-sized trees are poor habitats for grouse. The better habitats are on the lower hills and slopes and along the bottom lands. Thornapples, wild apple buds, dogwood and bittersweet berries, raspberries, beechnuts, buds and catkins of poplar and birch, wild cherries, hophornbeam nutlets, and a wide variety of other foods are eaten by grouse. Because the grouse forage from the ground to the top of trees, food seldom limits their number. The number fluctuates, however, for unknown reasons from time to time.

Woodcocks.—Areas where there are brushy, overgrown pastures, thickets of birch and poplar saplings, and somewhat open alder and willow swamps are good habitats for woodcocks. These areas are generally in the bottom lands

and on the lower slopes. The quality of the habitat declines rapidly when trees grow beyond the sapling stage and when brushy and swampy areas are no longer pastured.

Bears.—The black bears live mainly in soil associations 1 and 2. They find a suitable habitat in extensive woodlands with relatively few openings, a sparse human population, and plenty of food in great variety. Among their important foods are wild apples, wild cherries, blueberries, blackberries, raspberries, highbush cranberries, dogwood berries, beechnuts, and acorns. Bears, however, are not so common in this county as elsewhere in the State.

Other wildlife.—In the lower lying lands, especially in brushy tracts and in areas of much sapling growth, the New England cottontail is fairly common. Gray squirrels are well-distributed, particularly where there are many oak, beech, and hickory trees and hazelnut bushes. They are not so common in the more mountainous areas.

Beavers are not so numerous here as in other soil associations. They are more likely to be along the slower flowing streams in limited areas of bottom lands than in more hilly areas. Beavers sooner or later appear in swampy areas that have an abundance of poplar and willow trees.

Wildcats are fairly common throughout the area occupied by these soil associations, especially where there are ledges. They hunt largely where snowshoe hares, chipmunks, deer mice, and red and gray squirrels abound. Moose are rare. Red foxes probably have decreased in number because farmland has been abandoned and has grown up in trees. Brushy pastures, meadows, and edges of woodlands are the main habitats of red foxes. Meadow mice, woodchucks, and cottontails, the principal animals eaten by foxes, live mostly in farming areas. Although gray foxes are more a woodland animal than the red foxes, gray foxes are scarcer in this county. Raccoons are common, especially near lakes, ponds, and streams, Mink, although not abundant, are high in value. There are a few fishers that occur only in the heavily forested northwestern part of the county. Skunks are common in the relatively few open areas, and muskrats in the bottom lands.

Other typical wildlife in these associations are porcupines, red squirrels, red-backed mice, woodland jumping mice, chipmunks, and weasels.

There are many kinds of warblers and thrushes in the spruce-fir woodlands, and many kinds of vireos, warblers, and woodpeckers in the hardwood and mixed woodlands. Open and brushy areas provide habitats for various kinds of sparrows, flycatchers, warblers, and blackbirds.

Soil associations 3 and 5

These associations are in the central and southeastern parts of the county. They are made up of sandy and gravelly plains, terraces, and ridges occupied by the Hinckley, Windsor, and Au Gres soils and low, rounded hills occupied by the Gloucester, Shapleigh, and Whitman soils.

These associations are largely forested. Farmed fields generally are small, scattered, and rocky. In woodlands, sugar maple, beech, white pine, hemlock, red oak, yellow birch, and red pine predominate. White birch, gray birch, red maple, white oak, white ash, basswood, and hickory also occur. The droughtiness of some soils and the wetness of others slow the growth of conifers. Such droughty and wet sites are generally favorable for wildlife. In the drier areas, shrubby oak, sweetfern, low blueberry, and pin cherry are among the low-growing food plants useful to wildlife; in the wetter areas, highbush blueberry, dogwood, and poplar are important food-producing plants.

Although production of timber is poor on some of these soils, harvesting it is easier than in the mountains. Clean harvest of softwoods favor the growth of many hardwoods and shrubs that provide food for wildlife.

The more important kinds of wildlife in associations 3 and 5 and their habitats are discussed in the following paragraphs.

Deer.—In this area the variety of native forage plants, the coniferous cover, the small pastures and meadows, and the swamps provide a good habitat for deer. This is one of the better deer-hunting areas in the State.

Snowshoe hares.—The number of snowshoe hares has varied widely, ranging from near extinction to a moderate number. Studies of the hare in New England show that areas in gray birch and poplar saplings, which often follow clean cutting, provide fair habitats. These habitats, however, are inferior to those in areas of young conifers, particularly spruce, fir, and white-cedar.

Ruffed grouse.—The grouse habitats in these soil associations are probably better than those in other parts of the county. Edges of meadows and pastures, overgrown fields, cutover areas, brushy stone walls and roadsides, and alder swamps, together with limited cover of conifers, occur in many places. These provide sites favorable for grouse. Despite the quality of the habitats, however, the number of grouse often decreases at intervals.

Woodcocks.—The woodcock habitats in this area are better than that in soil associations 1 and 2. Swampy areas on the Whitman soils provide good feeding places. Partly open brushy areas and groves of birch saplings and poplar saplings, which follow clean cutting or invade abandoned fields, provide nesting grounds. The shallow, droughty Shapleigh soils can be used by woodcock for nesting and for rearing the brood.

Other wildlife.—Little study has been made of cottontails in New Hampshire. Scattered farm fields, overgrown stone walls, brushy and cutover areas, and young woodlands are the main habitats of the New England cottontail. This animal does not venture into the open so much as the more southerly Eastern cottontail of Massachusetts and Connecticut. The habitats in this area should be superior to those in soil associations 1 and 2. Because of the somewhat greater number of oak, hickory, ash, and other food-producing plants in associations 3 and 5, they provide good habitats for gray squirrels.

The very poorly drained Whitman and Ridgebury soils and areas of Muck and Peat and of Marsh provide conditions favorable for beaver, which are common. Because the gradient of streams is lower in this area than in the mountainous area, conditions are better for beaver dams.

Other wet areas, naturally attractive to raccoons, minks, and muskrats, are frequent and well distributed throughout soil associations 3 and 5. Wood ducks and black ducks in limited numbers nest in the marshes and swamps that are numerous in soil association 5.

Wet lands furnish one of the distinctive habitats for birds. Characteristic species are the yellow warblers, yellowthroats, bitterns, and green herons.

Soil associations 4 and 6

These soil associations make up the principal farming and residential areas of the county. Association 4 is made up mainly of Paxton, Shapleigh, and Woodbridge soils on drumlins. These soils are mainly in the northeastern part of the county, but scattered areas occur elsewhere. In association 6 are the flood plains and terraces that bisect the county in a north-south direction along the Merrimack River and in an east-west direction along the Contoocook and Suncook Rivers. The main soils are the Ondawa, Windsor, and Agawam.

Dairying, poultry farming, and orcharding are the main farm enterprises. Woodlands have trees similar to those in associations 3 and 5. Bottom land species, such as American elm, red maple, and willow, are common in hedgerows and along streams.

Deer.—Deer commonly graze in pastures and meadows. These feeding areas are particularly useful to deer early in spring and in summer. Deer consume about 2½ pounds (dry weight) of forage daily for each 100 pounds of body weight. Unless they are very numerous, deer seldom do much permanent damage to hay or pasture. Limed and fertilized grasses and legumes are especially attractive to deer. Dropped apples and apple buds are eaten by deer, which sometimes damage orchards.

Grouse.—Grouse frequent overgrown pastures and abandoned fields. They are said to do some damage to apple buds, but this damage is difficult to distinguish from that caused by other birds.

Other wildlife.—Cottontails are of little significance except along field borders and pasture borders and in overgrown areas and wooded areas. Gray squirrels occur throughout these soil associations but are not as numerous as in soil associations 3 and 5. Many kinds of waterfowl, notably, buffleheads, goldeneyes, and mergansers, are on the Merrimack River during the migration period. Sometimes they remain throughout the winter. Pheasants are released annually in the county. However, because of the soils, which are mostly glacial, the type of farming, and the size of fields, these associations do not provide habitats that are conducive to natural production of pheasants. There are, however, possibilities for shooting-preserves for pheasant hunting.

Beaver occur to some extent in these associations. Flooding of land, roads, and culverts by their dams is sometimes a nuisance. Farmed areas, pastures, orchards, and stone walls provide good habitat for red foxes, skunks, and weasels. Muskrats and raccoons frequent the streams and farm ponds.

Nongame species.—More open-land birds occur in these associations than in associations 1 and 2 or 3 and 5. Typical birds are orioles, meadowlarks, redwinged blackbirds, bobolinks, catbirds, brown thrashers, song sparrows, and field sparrows. Other interesting kinds of wildlife on farmland include meadow jumping mice, meadow mice, woodchucks, and the harmless garter snakes, milk snakes, and smooth green snakes.

Suitability of soils for wildlife habitats

In table 4 the soils are rated for their suitability for the establishment, improvement, or maintenance of particular kinds of wildlife habitats (*1*). Also rated in this table is the suitability of the soils for openland, woodland, and wetland wildlife. The habitats used in the table are defined as follows:

GRAIN AND SEED CROP HABITAT: Areas of domestic grains or seed-producing annual herbaceous plants that have been planted to provide food for wildlife. Suitable plants are corn, wheat, millet, buckwheat, cowpeas, soybeans, and sunflowers.

GRASS AND LEGUME HABITAT: Areas of domestic perennial grasses and herbaceous legumes that have been planted to provide wildlife food and cover. Suitable plants are tall fescue, bromegrass, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, and alfalfa.

WILD HERBACEOUS UPLAND PLANT HABITAT: Native or domestic perennial grasses and forbs (weeds) that provide food and cover mainly for wildlife on uplands and which are established in most places by natural processes. Examples of these plants are bluestem, Indiangrass, wheatgrass, strawberry, beggarweed, wild bean, nightshade, glodenrod, and dandelion.

HARDWOOD WOODLAND PLANT HABITAT: Hardwood trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs, or foliage consumed extensively by wildlife and that are commonly established through natural processes. They may also be planted. Examples of these plants are oak, beech, cherry, hawthorn, dogwood, viburnum, maple, birch, poplar, blueberry, brier, and rose.

CONIFEROUS WOODLAND PLANT HABITAT: Coniferous trees and shrubs that are mainly important as cover for wildlife but may also furnish food as browse, seeds, or fruitlike cones. Commonly they are established through natural processes, but they may also be planted. Examples of these plants are pine, spruce, white-cedar, hemlock, balsam fir, red-cedar, juniper, and yew.

WETLAND PLANT HABITAT: Annual and perennial, wild herbaceous plants in moist to wet areas, exclusive of submerged or floating aquatic plants, that produce food or cover extensively used by Wetland wildlife. Examples of such plants are smartweed, wild millet, bulrush, spikesedge, rush, sedge, burreed, reed, wildrice, rice, rice cutgrass, switchgrass, mannagrass, bluejoint, and cattail.

SHALLOW WATER HABITAT: Areas where water is controlled by impoundment, excavation, or other means and generally does not exceed 5 feet in depth. Structures include low dikes and levees, shallow dugout ponds, level ditches, and other devices to control the level of water in marshy streams or drainage channels.

EXCAVATED POND HABITAT: Dugout ponds or a combination of dugout ponds and low dikes or dams that hold enough water of suitable quality and depth to support fish or wildlife. Ponds should have at least one-tenth of an acre of surface area and an average depth of 6 feet over at least one-fourth of the area. Also, a high water table or other dependable source of unpolluted water of low acidity is needed.

The kind of wildlife, as used in table 4, are defined as follows:

OPENLAND WILDLIFE: Included in this category are birds and mammals that normally frequent croplands, pastures, meadows, lawns, and areas overgrown with

grasses, forbs, and shrubs. Examples of these forms are pheasants, meadowlarks, field sparrows, redwinged blackbirds, red foxes, and woodchucks.

WOODLAND WILDLIFE: Included in this category are birds and mammals that normally frequent woodlands made up of hardwood trees, shrubs, and vines; coniferous trees and shrubs; or a mixture of these plants. Examples of these forms of wildlife are ruffed grouse, woodcocks, thrushes, vireos, scarlet tanagers, gray squirrels, red squirrels, white-tailed deer, and raccoons.

WETLAND WIDLIFE: Included in this category are birds and mammals that normally frequent ponds, marshes, swamps, and other wet areas. Examples of these forms are black ducks, wood ducks, rails, herons, shore birds, minks, muskrats, and beavers.

Engineering Interpretations of Soils [4]

This soil survey report was made primarily for agricultural purposes, but it has considerable value for other users. It can be used by engineers in making plans for highways, dams, canals, ditches, and various other structures.

The information in this report can be used to:

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make estimates of runoff and erosion characteristics for use in watershed planning and planning soil and water conservation structures.
3. Make preliminary estimates of engineering properties of soil in planning agricultural drainage systems, irrigation systems, farm ponds, and diversion terraces.
4. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway and airport locations, and in planning detailed investigations at the selected location.
5. Locate probable sources of sand, gravel, or other construction materials.
6. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining engineering structures and practices.
7. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
8. Supplement information from other sources for making soil maps and reports that can be used readily by engineers.
9. Develop other preliminary estimates for construction purposes applicable to the particular area.

To be able to make the best use of soil maps and the soil survey reports, the engineer should know the physical properties of the soil materials and the in-place condition of the soil. After testing soil materials and observing the behavior of soils when used in engineering structures and foundations, the engineer can develop design recommendations for the soil units delineated on the maps.

It is not intended that this report will eliminate the need for on-site sampling and testing of sites for design and construction of specific engineering works and uses. It should be used only in planning more detailed field surveys to determine the condition of the soil, in place, at the site of the proposed engineering construction.

Information regarding the behavior and properties of the soils in Merrimack County can be obtained from the detailed soil map at the back of this report and from tables 5, 6, and 7 in this section. The information in the tables was obtained and evaluated from field experience performance, and the result of tests such as that shown in table 5. The data contained in table 5, as well as other assistance, were furnished by the U.S. Bureau of Public Roads.

Some of the terms used by soil scientists may have a special meaning in soil science and may be unfamiliar or have a different meaning to engineers. These terms are defined in the Glossary at the back of this report.

Engineering classification

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (AASHO) (*2*). In this system soil materials are classified in seven principal groups based on field performance. The groups range from A–1, consisting of gravelly and coarse sandy soils of high bearing capacity, to A–7, consisting of clayey soils having low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. These numbers range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol in table 5.

Some engineers prefer to use the Unified soil classification system (*10*). In this system the soils are identified according to their texture and plasticity and are grouped according to their performance as engineering construction material. Soil materials are classified as coarse grained (8 classes), fine grained (6 classes), or highly organic. An approximate classification can be made in the field. For exact classification, mechanical analyses and Atterburg limits are needed. The classification of the soils in the county by the Unified system is given in tables 5 and 6.

Engineering test data

Engineering test data for eight different soil types of six soil series are given in table 5. Laboratory tests of samples of the horizons of these soils were made by the Bureau of Public Roads.

These data were used in estimating the engineering performance of these soils in Merrimack County. In addition, tests were made on samples of soils of three series in bordering Rockingham County, and these results were published in the soil survey of that county (*9*). Soils of these series are also in Merrimack County.

One set of samples was taken from a profile that represents the central concept, or modal profile, of each series. The other samples represent significant variations in texture (grain size), depth, or other variations from the modal profile. Although each soil series was sampled in more than one place, the data probably do not show the maximum variations in the horizons of each soil series. At most sites, samples of the horizons were obtained to a depth of 7 feet or less. The test data, therefore, may

[4] This section was written by HENRY STAMATEL, engineering specialist, Soil Conservation Service.

not be a suitable basis for estimating the characteristics of soil materials from deep cuts.

The soil classifications in table 5 were made on the basis of data obtained by mechanical analyses and by tests to determine the liquid limit and the plastic limit. Mechanical analyses were made by the combined sieve and hydrometer methods. The percentages of clay obtained by the hydrometer method should not be used in naming textural classes of soils.

Table 5 gives compaction (moisture-density) data for some of the tested soils. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains the same, the density of the compacted material will increase until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest density obtained in the compaction test is termed maximum density. Moisture-density data are important in earthwork, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum density, when it is at approximately the optimum moisture content.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a fine grained soil increases from the very dry state, the material changes from a solid to a semisolid or a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic state to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Soil properties significant to engineering

In table 6 the soils are listed in alphabetic order with their map symbols; a brief description of each soil is given; and some physical properties significant to engineering are estimated. The information in this table is based on field experience, performance of the soils, and test data in table 5.

In table 6 the rating for permeability expresses the ability of the soil to transmit water or air. Permeability was estimated for soil material in place without compaction. It depends largely on texture, structure, and porosity.

Available water capacity is expressed in this table in inches per inch of depth. It is approximately the amount of capillary water in the soil layer when it is wet to field capacity. When the soil layer is air dry, this amount of water will wet it to a depth of 1 inch without deeper penetration. All of this water can be taken up by plants. The table gives available water capacity in inches per inch of soil for the horizon shown.

The shrink-swell potential indicates the volume change to be expected with changes in moisture content of the soil. Density, structure, and mineralogic composition and the amount and type of clay are factors that influence this property. If soil materials have a high shrink-swell potential, they are normally undesirable for engineering works. The change in volume is usually accompanied by a loss of bearing capacity or by high swelling pressures.

In table 7 the soils are rated for susceptibility to frost action and for the suitability as a source of topsoil, sand, gravel, and road fill. Also shown in the table are soil features affecting highway location, farm ponds, agricultural drainage, terraces and diversions, and similar structures. These ratings are based on field experience, performance of the soils, and test data in table 5.

The estimates for susceptibility to frost action are for soils as they occur in place. Soils that contain a high percentage of silt and very fine sand and are wet during the freezing period are rated high in susceptibility to frost action. Water may come from a high water table, from capillary action, through infiltration, or from water held within the voids of the soil. Soils that have a deep water table or those that have a very small percentage of fine material range from moderate in susceptibility to not susceptible to frost action. A more specific rating would depend on the grain size and grading of the soil material and the depth of the associated water table or other source of water.

Estimated suitability of the soils for road fill is also given in this table. Free-draining, sandy or gravelly materials with a deep water table are rated *good*. The fine-grained soils are rated *fair* or *poor*. Considered in these ratings are workability, natural drainage, depth to bedrock, erodibility, bearing capacity, and the stability of the soil.

The soils are rated in table 7 as a source of topsoil for covering embankments, ditches, and cut slopes. Normally only material from the surface layer is used, and the ratings apply only to nonstony soils. Soils that are too wet, shallow, sandy, or gravelly for use as topsoil are rated poor or not suitable.

Exploration may be needed to find sand and gravel that fulfill the requirements for specific kinds of construction. To be rated as good or fair, sand or gravel must be extensive. Some of the soils rated as good or fair may require processing for making them less susceptible to frost action or for other purposes.

Also listed in table 7 are features that adversely affect specific structures. These hazards or soil characteristics indicate that special planning, design, or construction may be necessary for the specified structure.

Omitted from table 7 are Gravel pits and Made land. These land types vary so much in their characteristics that interpretations for an entire mapping unit is not possible. Interpretations can be made at the site of each proposed engineering structure.

The data in table 7, however, do not account for all factors affecting engineering work. Engineering information about selected characteristics of soils can be obtained from the soil maps. More detailed information is in the section "Descriptions of the Soils." Content of stones, depth to bedrock, and reaction are factors that affect engineering work on many of the soils in the county.

TABLE 5.—*Engineering*

Soil name and location	Parent material	Bureau of public roads report No.	Depth	Horizon	Moisture-density[2] Maximum dry density	Moisture-density[2] Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Acton fine sandy loam: 1 mile NE. of intersection of U.S. Highway No. 3 and State Route 106. (Modal)	Glacial till.	S36106	0 to 7	Ap	--------	--------
		S36107	11 to 19	B22	--------	--------
		S36108	39 to 55+	Cm	--------	--------
1 mile NE. of church on U.S. Highway No. 3, Pembroke. (Thicker B horizon)	Glacial till.	S36109	0 to 10	Ap	--------	--------
		S36110	17 to 22	B22g	--------	--------
		S36111	42 to 62	B33mg	--------	--------
Acton gravelly sandy loam: ¼ mile E. of Goffstown-Hooksett town line. (More gravel)	Glacial till.	S36112	0 to 8	Ap	--------	--------
		S36113	8 to 15	B21	--------	--------
		S36114	22 to 24+	B23gm	--------	--------
Au Gres loamy sand: ¼ mile S. of State Route 28 on U.S. Highway No. 3. (Modal)	Glaciofluvial sand.	S36123	0 to 10	Ap	--------	--------
		S36124	10 to 19	A2	--------	--------
		S36125	29 to 37	B23m	--------	--------
¾ mile E. of State Route 3B on Hoyt Road. (Weak ortstein variant)	Glaciofluvial sand.	S36126	0 to 8	Ap	--------	--------
		S36127	12 to 26	B22m	--------	--------
		S36128	26 to 56+	Cg	--------	--------
Webber Farm on Graham Road in East Concord. (Deep B variant)	Glaciofluvial sand.	S36129	0 to 7	Ap	--------	--------
		S36130	7 to 10	A21	--------	--------
		S36131	25 to 31	B22m	--------	--------
Hinckley gravelly loamy sand: 0.2 mile S. of Poverty Plains Road and 0.3 mile W. of State Route 127. (Modal)	Glaciofluvial sand and gravel.	S37121	0 to 8	Ap	--------	--------
		S37122	8 to 15	B21	--------	--------
		S37123	20 to 48+	D	--------	--------
Hinckley loamy sand: 1.2 miles S. of Concord Airport. (Fine gravel variant)	Glaciofluvial sand and gravel.	S37124	2 to 8	B21	--------	--------
		S37125	13 to 20	B3	--------	--------
		S37126	20 to 40+	D	--------	--------
500 feet S. of Haines Road and 100 feet E. of State Route 106. (Shallow-to-gravel variant)	Glaciofluvial sand and gravel.	S37127	2 to 7	B2	--------	--------
		S37128	7 to 50+	D	--------	--------
Ridgebury loam: 1 mile NE. of church on U.S. Highway No. 3, Pembroke. (Modal)	Glacial till.	S36115	0 to 9	AP	--------	--------
		S36116	31 to 49	B32gm	--------	--------
		S36117	49 to 69+	C	--------	--------
20 yards W. of intersection at top of Pembroke Hill. (Deeper pan)	Glacial till.	S36118	0 to 8	Ap	--------	--------
		S36119	23 to 35	B23g	--------	--------
		S36120	60 to 73+	Cg	--------	--------
McCormack Field, Oak Hill Road, Concord. (Shallower pan)	Glacial till.	S36121	0 to 9	Ap	--------	--------
		S36122	18 to 32+	B22gm	--------	--------
Windsor loamy sand: 2 miles N. of East Concord. (Modal)	Glaciofluvial sand.	S34111	3 to 9	B21	106	14
		S34112	15 to 50	C1	105	15
1 mile N. of Merrimack River bridge and 200 yards W. of railroad. (C2u horizon)	Glaciofluvial sand.	S34113	0 to 7	Ap	110	31
		S34114	9 to 25	B22	111	12
		S34115	46 to 63	C3	100	17
		S34116	63 to 66+	Dg	105	11

See footnotes at end of table.

test data [1]

Mechanical analysis [3] — Percentage passing sieve [4]— 3 in.	¾ in.	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Percentage smaller than [4]— 0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	Liquid limit	Plasticity index	Classification — AASHO [5]	Unified [6]
100	99	97	96	87	64	53	26	10	7	[7] NP	[7] NP	A-4(6)	ML.
100	97	93	90	73	39	31	14	5	2	NP	NP	A-4(1)	SM.
100	96	92	86	66	28	24	12	5	3	NP	NP	A-2-4(0)	SM.
100	99	97	95	80	48	41	22	9	5	31	6	A-4(3)	SM.
100	97	93	88	66	25	19	10	4	2	NP	NP	A 2-4(0)	SM.
100	94	89	84	60	23	18	9	4	1	NP	NP	A-2-4(0)	SM.
100	87	75	70	54	29	25	15	7	4	NP	NP	A-2-4(0)	SM.
100	85	63	52	33	11	9	5	2	1	NP	NP	A-1-b(0)	SP-SM.
100	98	90	85	67	39	34	17	6	2	NP	NP	A-4(1)	SM.
--------	--------	--------	100	91	40	35	20	8	4	NP	NP	A 4(1)	SM.
--------	100	97	96	84	19	16	11	6	3	NP	NP	A-2-4(0)	SM.
--------	--------	--------	100	84	6	5	3	1	0	NP	NP	A-3(0)	SP-SM.
--------	--------	--------	100	88	41	34	16	6	3	NP	NP	A-4(1)	SM.
--------	--------	--------	100	69	14	9	4	2	1	NP	NP	A-2-4(0)	SM.
--------	--------	--------	100	62	12	10	3	2	1	NP	NP	A-2-4(0)	SW-SM.
--------	--------	--------	100	90	38	31	15	5	2	NP	NP	A-4(1)	SM.
--------	--------	--------	100	90	40	32	15	5	1	NP	NP	A-4(1)	SM.
--------	--------	--------	100	78	13	8	4	2	1	NP	NP	A-2-4(0)	SM.
100	93	79	70	48	10	9	6	3	1	NP	NP	A 1-b(0)	SW-SM.
100	99	92	85	64	14	12	6	3	2	NP	NP	A-2-4(0)	SM.
[8] 90	86	62	40	13	1	1	0	0	0	NP	NP	A-1-a(0)	SP.
--------	--------	--------	100	67	16	13	7	4	2	NP	NP	A-2-4(0)	SM.
--------	--------	--------	100	64	9	6	2	1	1	NP	NP	A-3(0)	SP-SM.
100	98	70	54	22	4	3	1	0	0	NP	NP	A-1-b(0)	SP.
[8] 90	52	35	32	22	8	7	4	2	1	NP	NP	A-1-a(0)	GP-GM.
[9] 50	38	27	18	8	2	1	1	0	0	NP	NP	A-1-a(0)	SP.
100	97	94	92	83	58	51	26	9	6	NP	NP	A-4(5)	ML.
100	88	78	73	53	20	18	9	4	2	NP	NP	A-2-4(0)	SM.
100	93	88	84	67	33	28	18	8	5	NP	NP	A-2-4(0)	SM.
--------	100	98	96	84	58	52	30	12	7	40	7	A-4(5)	ML.
100	94	86	81	60	22	16	6	2	1	NP	NP	A-2-4(0)	SM.
100	97	95	91	74	35	30	19	10	5	NP	NP	A-2-4(0)	SM.
100	94	92	90	79	52	45	25	9	5	NP	NP	A-4(3)	ML.
100	98	96	92	76	28	21	8	3	2	NP	NP	A 2 4(0)	SM.
--------	--------	--------	100	89	11	8	4	2	1	NP	NP	A-2-4(0)	SP-SM.
--------	--------	--------	100	83	3	2	2	1	1	NP	NP	A-3(0)	SP.
--------	--------	--------	100	89	23	15	6	2	2	NP	NP	A-2-4(0)	SM.
--------	--------	--------	100	81	22	12	3	1	1	NP	NP	A-2-4(0)	SM.
--------	--------	--------	--------	100	13	5	2	1	1	NP	NP	A-2-4(0)	SM.
--------	100	99	93	23	1	1	1	1	1	NP	NP	A-1-b(0)	SP.

TABLE 5.—*Engineering*

Soil name and location	Parent material	Bureau of public roads report no.	Depth	Horizon	Moisture-density [2] Maximum dry density	Moisture-density [2] Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Windsor loamy sand—Continued						
1 mile N. of Sewalls Falls Road on State Route 3B. (Dg horizon)	Glaciofluvial sand.	S34117	0 to 7	Ap	109	14
		S34118	7 to 13	B21	110	14
		S34119	38 to 73	C2	104	16
		S34120	73 to 75+	Dg	100	21
Woodbridge loam:						
100 yards N. of Mt. Kearsarge dairy bar on U.S. Highway No. 4. (Modal)	Glacial till.	S37129	0 to 7	Ap	--------	--------
		S37130	7 to 13	B21	--------	--------
		S37131	18 to 36+	Cgm	--------	--------
50 yards SE. of Andover-Salisbury town line. (Sandy C variant)	Glacial till.	S37132	0 to 8	Ap	--------	--------
		S37133	8 to 14	B21	--------	--------
		S37134	27 to 36+	C2gm	--------	--------
Copoco Field, on Little Pond Road. (Bisequum variant)	Glacial till.	S37135	0 to 13	Ap	--------	--------
		S37136	16 to 22	B22g	--------	--------
		S37137	25 to 46	B21gm	--------	--------

[1] Tests performed by the Bureau of Public Roads according to standard procedures of the American Association of State Highway Officials (AASHO).
[2] Based on AASHO Designation: T 99-57, Method A or C. (*2*).
[3] Mechanical analyses according to the American Association of State Highway Officials Designation: T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

TABLE 6.—*Estimated physical properties*

[Absence of data indicates

Map symbol	Soil	Description of soil and site	Depth to bedrock	Depth to seasonally high water table	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
AcB	Acton fine sandy loam, 0 to 8 percent slopes.	2 to 3 feet of fine sandy loam to gravelly loamy sand over gravelly loamy sand; developed in glacial till derived from granite, gneiss, and schist on uplands; stones and boulders throughout the profile; seepage on some hillsides; compact layers that are softer when wet occur in places.	3+	1½	0 to 7
AdB	Acton very stony fine sandy loam, 0 to percent slopes.				7 to 34
AdC	Acton very stony fine sandy loam, 8 to 15 percent slopes.				34 to 39+
AfA	Agawam very fine sandy loam, 0 to 3 percent slopes.	2½ feet of very fine sandy loam over water-sorted fine sand; derived from schist, granite and gneiss; little or no gravel; upper part is high in very fine sand and silt; soils occur on stream terraces.	5+	5+	0 to 29
AfB	Agawam very fine sandy loam, 3 to 8 percent slopes.				29 to 45+
AgA	Au Gres fine sandy loam, 0 to 3 percent slopes.	2 feet of loamy sand underlain by sand; in depressions on sandy plains and on terraces; a discontinuous cemented sandy layer at a depth of about 2 feet, and a water table that fluctuates from near the surface to a depth of 6 feet.	5+	0	0 to 12
AgB	Au Gres fine sandy loam, 3 to 8 percent slopes.				12 to 26
AuB	Au Gres loamy sand, 0 to 8 percent slopes.				26 to 56+

See footnote at end of table.

test data [1]—Continued

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve [4]—						Percentage smaller than [4]—							
3 in.	¾ in.	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
--------	--------	--------	100	87	21	17	9	5	2	NP	NP	A-2-4(0)	SM.
--------	--------	--------	100	86	18	13	7	4	2	NP	NP	A-2-4(0)	SM.
--------	--------	--------	100	92	25	11	2	1	1	NP	NP	A-2-4(0)	SM.
--------	--------	--------	--------	100	97	94	79	45	16	34	10	A-4(8)	ML-CL.
100	99	97	95	83	50	45	25	10	6	43	5	A-5(3)	SM.
100	99	95	91	78	43	36	19	8	4	NP	NP	A-4(2)	SM.
100	98	95	90	75	39	32	19	8	5	NP	NP	A-4(1)	SM.
100	98	96	94	84	50	41	22	11	6	33	6	A-4(3)	SM.
100	94	89	87	76	40	34	19	10	3	NP	NP	A-4(1)	SM.
100	98	93	88	70	27	22	12	6	3	NP	NP	A-2-4(0)	SM.
100	96	91	88	76	49	44	25	11	5	36	6	A-4(3)	SM.
100	99	93	89	75	44	37	21	10	4	NP	NP	A-4(2)	SM.
--------	100	98	95	81	48	43	30	17	11	18	4	A-4(3)	SM-SC.

[4] Based on total material. Laboratory test data corrected for amount discarded in field sampling.
[5] Based on "Standard Specifications for Highway Materials and Methods of Sampling and Testing" (Pt. 1, Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. AASHO Designation: M 145—49 (*2*).
[6] Based on the Unified Soil Classification System, Tech. Memo. No. 3-357, v. 1, Waterways Expt. Sta., Corps of Engin., March 1953 (*10*).
[7] Nonplastic.
[8] Estimated 10 percent of material, 3 to 10 inches in diameter, discarded in field sampling.
[9] Estimated 50 percent of material, 3 to 10 inches in diameter, discarded in field sampling.

significant to engineering

information does not apply]

Classification		Percentage passing —[1]				Permeability	Available water capacity	Shrink-swell potential
Unified	AASHO	3-inch sieve	No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)			
							Inches per inch of depth	
ML, SM	A-2, A-4	85 to 100	75 to 100	50 to 95	30 to 60	Rapid	0.17 to 0.13	Low.
SM, GM	A-1, A-2, A-4.	85 to 100	55 to 95	45 to 95	10 to 40	Rapid	0.08 to 0.13	Low.
SM	A-2, A-4	85 to 100	75 to 90	70 to 90	20 to 40	Slow	0.05 to 0.08	Low.
ML, SM	A-4	100	100	100	45 to 60	Rapid	0.13 to 0.17	Low.
SM	A-2, A-4	100	100	100	30 to 50	Rapid	0.08 to 0.13	Low.
SM	A-4	100	95 to 100	85 to 100	35 to 45	Rapid	0.08 to 0.13	Low.
SM	A-2, A-4	100	95 to 100	80 to 100	15 to 40	Moderate	0.08 to 1.0	Low.
SP-SM	A-3, A-2	100	85 to 100	70 to 100	5 to 15	Rapid	0.08 to 0.13	Low to none.

TABLE 6.—*Estimated physical properties*

Map symbol	Soil	Description of soil and site	Depth to bedrock	Depth to seasonally high water table	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
BcB	Belgrade silt loam, 0 to 8 percent slopes.	1 foot to 1½ feet of silt loam over deposits of varved silt, very fine sand, and clay; developed in old glacial lakebeds.	5+	1½	0 to 17 17 to 40+
CaC CaD ChD ChE	Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes. Canaan-Hermon very rocky sandy loams, 15 to 25 percent slopes. Canaan-Hermon extremely rocky sandy loams, 8 to 25 percent slopes. Canaan-Hermon extremely rocky sandy loams, 25 to 60 percent slopes.	1 foot to 2 feet of sandy loam over bedrock; developed in glacial till derived from granite, gneiss, and schist; occur on the tops and sides of hills and mountains where temperature is cooler and precipitation is greater; stones and boulders common throughout the profile; in many places bedrock crops out. Description and estimated physical properties are for the Canaan soils. See Hermon soils for further description and estimated properties.	0 to 2	0 to 2	0 to 15
CoA CoB CoC CtE	Colton loamy sand, 0 to 3 percent slopes. Colton loamy sand, 3 to 8 percent slopes. Colton loamy sand, 8 to 15 percent slopes. Colton gravelly loamy sand, 15 to 60 percent slopes.	1 foot to 2 feet of loamy sand to gravelly loamy sand over layers of water-sorted sand and gravel; occur on kames, kame terraces, eskers, and outwash plains at higher elevations where temperature is cooler and precipitation is greater.	5+	5+	0 to 24 24 to 50+
DuB	Duane fine sandy loam, 0 to 8 percent slopes.	1 foot to 1½ feet of sandy loam over layers of water-sorted sands and gravel; occurs in slight depressions on outwash plains and on lower slopes of kames and terraces where temperature is cooler and precipitation is greater.	5+	1½	0 to 15 15 to 26+
GcB GcC GcD GrB GrC GrD GrE GsD GsE	Gloucester sandy loam, 3 to 8 percent slopes. Gloucester sandy loam, 8 to 15 percent slopes. Gloucester sandy loam, 15 to 25 percent slopes. Gloucester very stony sandy loam, 3 to 8 percent slopes. Gloucester very stony sandy loam, 8 to 15 percent slopes. Gloucester very stony sandy loam, 15 to 25 percent slopes. Gloucester very stony sandy loam, 25 to 60 percent slopes. Gloucester extremely stony sandy loam, 8 to 25 percent slopes. Gloucester extremely stony sandy loam, 25 to 60 percent slopes.	2 to 2½ feet of sandy loam to loamy sand underlain by loamy sand glacial till; developed on uplands in glacial till derived from granite, gneiss, and schist; stones and boulders throughout profile.	3+	3+	0 to 33+
Gv	Gravel pits.	Extremely variable material; includes sand pits and borrow pits in other materials.	----------	----------	----------
HmB HmC HmD HnB HnC HnD HoD HoE	Hermon sandy loam, 3 to 8 percent slopes. Hermon sandy loam, 8 to 15 percent slopes. Hermon sandy loam, 15 to 25 percent slopes. Hermon very stony sandy loam, 3 to 8 percent slopes. Hermon very stony sandy loam, 8 to 15 percent slopes. Hermon very stony sandy loam, 15 to 25 percent slopes. Hermon extremely stony sandy loam, 8 to 25 percent slopes. Hermon extremely stony sandy loam, 25 to 60 percent slopes.	2 to 2½ feet of sandy loam to loamy sand underlain by loamy sand glacial till; developed on uplands in glacial till derived from granite, gneiss, and schist; occurs at higher elevations where temperature is cooler and precipitation is greater; stones and boulders throughout the profile.	3+	3+	0 to 30+

See footnote at end of table.

significant to engineering—Continued

Classification		Percentage passing —[1]				Permeability	Available water capacity	Shrink-swell potential
Unified	AASHO	3-inch sieve	No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)			
							Inches per inch of depth	
ML, CL	A-4	100	100	100	85 to 100	Moderate	0. 17 to 0. 23	Moderate to low.
ML, CL	A-6	100	100	100	85 to 100	Slow	0. 13 to 0. 17	Moderate.
SM-SP	A-1, A-2	85 to 100	75 to 90	60 to 80	5 to 30	Rapid	0. 08 to 0. 13	Low.
SP-SM, SM, GP-GM, GM.	A-1, A-2, A-3.	90 to 100	35 to 100	30 to 100	10 to 15	Very rapid	0. 08 to 0. 10	Low.
SP, GP	A-1	50 to 90	25 to 70	15 to 55	0 to 5	Very rapid	0. 05 to 0. 08	Low to none.
SM	A-2	90 to 100	60 to 95	50 to 95	10 to 30	Rapid	0. 08 to 0. 13	Low.
SM, SP	A-2, A-1, A-3.	90 to 100	60 to 95	40 to 85	0 to 15	Very rapid	0. 05 to 0. 08	Low to none.
SM, SP-SM	A-1, A-2	75 to 100	50 to 75	40 to 70	5 to 30	Rapid	0.08 to 0.13	Low.
SM, SP-SM	A-1, A-2	75 to 100	50 to 75	40 to 70	5 to 30	Rapid	0.08 to 0.13	Low.

TABLE 6.—*Estimated physical properties*

Map symbol	Soil	Description of soil and site	Depth to bedrock	Depth to seasonally high water table	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
HsA HsB HsC HrE	Hinckley loamy sand, 0 to 3 percent slopes. Hinckley loamy sand, 3 to 8 percent slopes. Hinckley loamy sand, 8 to 15 percent slopes. Hinckley gravelly loamy sand, 15 to 60 percent slopes.	1 foot to 2 feet of loamy sand to gravelly loamy sand overlying layers of water-sorted sand and gravel; occur on kames, kame terraces, eskers, and outwash plains.	5+	5+	0 to 19 19 to 70+
Lm	Limerick silt loam, high bottom.	½ to 1 foot of silt loam over varved silt loam that has lenses of silty clay and very fine sand; developed in very fine sand, silt, and clay; occurs on water-laid deposits and has a fluctuating high water table.	5+	0	0 to 36+
Ma	Made land.	Disturbed areas that have not developed under natural conditions and have been filled with various kinds of soil material; too variable to rate.	----------	----------	----------
Mh	Marsh.	Ponded with shallow water most of the year; too variable to rate.	----------	----------	----------
MmA MmB MmC	Merrimac sandy loam, 0 to 3 percent slopes. Merrimac sandy loam, 3 to 8 percent slopes. Merrimac sandy loam, 8 to 15 percent slopes.	1½ to 2 feet of sandy loam over layers of water-sorted sand and gravel; occur on sandy plains and kame terraces.	5+	5+	0 to 16 16 to 34+
Mn	Mixed alluvial land.	Sand, silt, gravel, and cobbles extremely variable in texture; usually poorly drained and subject to flooding; depth to bedrocks 5 feet or more and water table at surface; otherwise too variable to rate.	----------	----------	----------
Mp	Muck and Peat	1 inch or more of organic matter; occurs in depressions and former ponds that have been filled by plant remains; high water table at surface keeps organic matter saturated and helps to preserve it; too variable to rate.	----------	----------	----------
NnA	Ninigret very fine sandy loam, 0 to 3 percent slopes.	2½ to 3 feet of very fine sandy loam over layers of water-sorted fine sand; little or no gravel; occur in shallow depressions on glaciofluvial terraces.	5+	1½	0 to 31 31 to 60+
Of Oh	Ondawa fine sandy loam. Ondawa fine sandy loam, high bottom.	2 to 10 feet of fine sandy loam to loamy fine sand on flood plains in alluvium derived mainly from granite, gneiss, and schist; on low bottoms frequently flooded and high bottoms less frequently flooded; coarse sand and gravel below a depth of 2 feet in places along small streams.	5+	3+	0 to 48+
PaB PaC PaD PnB PnC PnD PnE	Paxton loam, 0 to 8 percent slopes. Paxton loam, 8 to 15 percent slopes. Paxton loam, 15 to 25 percent slopes. Paxton very stony loam, 3 to 8 percent slopes. Paxton very stony loam, 8 to 15 percent slopes. Paxton very stony loam, 15 to 25 percent slopes. Paxton very stony loam, 25 to 60 percent slopes.	1½ to 2 feet of loam overlying a compact, fine sandy loam pan layer; developed in glacial till derived from schist, gneiss, and granite; occur on the sharper crests and sides of drumlins; seepage above the pan layer appears at the surface in places on hillsides.	3+	2+	0 to 22 22 to 60+

See footnote at end of table.

significant to engineering—Continued

Classification		Percentage passing —[1]				Permeability	Available water capacity	Shrink-swell potential
Unified	AASHO	3-inch sieve	No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)			
							Inches per inch of depth	
SP-SM, SM, GP-GM, GM.	A-1, A-2, A-3.	90 to 100	35 to 100	30 to 100	10 to 15	Very rapid	0.08 to 0.10	Low to none.
SP, GP	A-1	50 to 90	25 to 70	15 to 55	0 to 5	Very rapid	0.05 to 0.08	Low to none.
ML, CL	A-4, A-6, A-7.	100	100	100	85 to 100	Slow	0.17 to 0.20	Moderate to low.
SM	A-1, A-2	100	65 to 100	55 to 100	10 to 30	Rapid	0.08 to 0.13	Low
SP, SM, GP, GM.	A-1, A-2	95	55 to 95	40 to 95	0 to 15	Very rapid	0.05 to 0.08	Low to none.
ML, SM	A-4	100	100	100	45 to 60	Rapid	0. 13 to 0. 17	Low.
SM	A-2, A-4	100	100	100	30 to 50	Rapid	0. 08 to 0. 13	Low.
ML, SM	A-4	100	90 to 100	80 to 100	40 to 80	Rapid	0. 13 to 0. 17	Low.
SM	A-2, A-4	90 to 100	60 to 80	55 to 80	25 to 45	Moderate	0. 13 to 0. 17	Low.
SM-SG, SM	SM-SC, SM	90 to 100	75 to 80	70 to 80	30 to 45	Slow	0. 05 to 0. 08	Low.

TABLE 6.—*Estimated physical properties*

Map symbol	Soil	Description of soil and site	Depth to bedrock	Depth to seasonally high water table	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
Po	Podunk fine sandy loam.	2 to 10 feet of fine sandy loam on flood plains; composed of sediment derived from granite, schist, and gneiss; in some places along small streams, layers of coarse sand and gravel occur below a depth of 2 feet.	5+	1½	0 to 40+
RbA RbB	Ridgebury loam, 0 to 3 percent slopes. Ridgebury loam, 3 to 8 percent slopes.	1 foot to 2 feet of loam to sandy loam over compact loam, sandy loam, or loamy sand; developed in glacial till derived from schist, granite, and gneiss; occur on uplands in depressions, on lower slopes, and on level to gently sloping crests of hills; have a fluctuating water table; stones and boulders throughout the profile.	3+	0	0 to 8 8 to 18 18 to 30+
RdA RdB	Ridgebury and Whitman very stony loams, 0 to 3 percent slopes. Ridgebury and Whitman very stony loams, 3 to 8 percent slopes.	1 foot to 2 feet of loam to sandy loam over compact loam, sandy loam, or loamy sand; developed in glacial till derived from schist, granite, and gneiss; in some places is waterlogged nearly all the year, although in most places the water table fluctuates; occur on uplands in depressions and on lower slopes; stones and boulders are on the surface and throughout the profile. Description and estimated properties are for the Whitman soils. See Ridgebury soils for their description and estimated properties.	3+	0	0 to 10 10 to 20 20 to 30+
Rh	Riverwash.	2 to 10 feet of sand, gravel, and cobbles on flood plains adjacent to streams; subject to frequent flooding; AASHO and Unified classifications and sieve sizes too variable to rate.	5+	0	----------
Ro	Rock outcrop.	Areas of nearly bare granite, gneiss, or schist bedrock; little or no soil; rock outcrop on mountains, hilltops, and steep cliffs.	0	----------	----------
Ru	Rumney fine sandy loam.	2 to 10 feet of fine sandy loam on flood plains in sediments derived from granite, schist, and gneiss; in places along small streams layers of coarse sand and gravel occur at a depth below 2 feet; frequently flooded.	5+	0	0 to 30+
Sa	Saco silt loam.	½ to 1 foot of silt loam over silty clay loam; derived from schist, granite, and gneiss; occurs in sloughs, oxbows, and depressions on bottom lands. Waterlogged nearly all the year and flooded frequently; surface layer highly organic.	5+	0	0 to 15
Sc	Scarboro fine sandy loam.	½ to 1 foot of fine sandy loam over loamy sand to sand; in many places the surface layer contains muck; occurs in depressions on sandy plains and terraces in water-sorted sandy material derived from granite, gneiss, and schist; saturated by a high water table most of the year.	5+	0	0 to 25+

See footnote at end of table.

significant to engineering—Continued

Classification		Percentage passing —[1]				Permeability	Available water capacity	Shrink-swell potential
Unified	AASHO	3-inch sieve	No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)			
							Inches per inch of depth	
ML, SM	A-2, A-4	100	75 to 100	60 to 100	30 to 80	Rapid	0. 13 to 0. 17	Low.
SM, ML	A-2, A-4	95 to 100	80 to 100	70 to 95	40 to 60	Moderate	0. 13 to 0. 17	Low.
SM	A-2	95 to 100	75 to 100	70 to 95	20 to 30	Moderate	0. 08 to 0. 13	Low.
SM	A-2	95 to 100	85 to 100	85 to 95	25 to 35	Slow	0. 05 to 0. 08	Low.
SM, ML	A-2, A-4	85 to 100	80 to 100	70 to 95	20 to 60	Moderate	0. 13 to 0. 17	Low.
SM	A-2	85 to 100	75 to 100	70 to 95	20 to 30	Moderate	0. 08 to 0. 13	Low.
SM	A-2	85 to 100	85 to 100	85 to 95	25 to 35	Slow	0. 05 to 0. 08	Low.
------	------	------	------	------	------	------	------	
------	------	------	------	------	------	------	------	
ML, SM	A-2, A-4	100	75 to 100	60 to 100	30 to 80	Rapid	0. 13 to 0. 17	Low.
ML, CL	A-4, A-6	100	100	100	80 to 100	Slow	0. 17 to 0. 23	Moderate to low.
SM, SP	A2, A-3, A-4	100	85 to 100	75 to 100	0 to 40	Rapid	0. 08 to 0. 13	Low.

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TABLE 6.—*Estimated physical properties*

Map symbol	Soil	Description of soil and site	Depth to bedrock	Depth to seasonally high water table	Depth from surface (typical profile)
			Feet	*Feet*	*Inches*
SgB SgC ShC ShD SoD SoE	Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes. Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes. Shapleigh-Gloucester very rocky sandy loams, 3 to 15 percent slopes. Shapleigh-Gloucester very rocky sandy loams, 15 to 25 percent slopes. Shapleigh-Gloucester extremely rocky sandy loams, 8 to 25 percent slopes. Shapleigh-Gloucester extremely rocky sandy loams, 25 to 60 percent slopes.	1 foot to 2 feet of sandy loam over bedrock; developed in glacial till derived from granite, gneiss, and schist; occur on the tops and sides of hills and mountains; stones and boulders common throughout the profile; in many places bedrock crops out in the rocky and extremely rocky Shapleigh soils. Description and estimated physical properties are for the Shapleigh soils. See Gloucester soils for their description and estimated properties.	0 to 2	0 to 2	0 to 22
SuA SuB	Sudbury fine sandy loam, 0 to 3 percent slopes. Sudbury fine sandy loam, 3 to 8 percent slopes.	1 foot to 1½ feet of sandy loam over layers of water-sorted sand and gravel; occur in slight depressions on outwash plains and on lower slopes of kames and terraces.	5+	1½	0 to 27 27 to 52+
Sy	Suncook loamy sand.	2 to 10 feet of loamy sand to sand on flood plains; in recent alluvium derived from granite, gneiss, and schist; usually occurs as narrow strips adjacent to streams, but some areas are broader.	5+	3+	0 to 44+
WdA WdB WdC WdE	Windsor loamy sand, 0 to 3 percent slopes. Windsor loamy sand, 3 to 8 percent slopes. Windsor loamy sand, 8 to 15 percent slopes. Windsor loamy sand, 15 to 60 percent slopes.	1 foot to 2 feet of loamy sand over deep, loose sand with little or no gravel; occurs on glaciofluvial terraces of water-sorted sand derived from granite, gneiss, and schist; in some places in the valley of the Merrimack River, deposits of silt and silty clay may occur at a depth below 6 feet.	5+	5+	0 to 9 9 to 62+
WoB WoC WvB WvC	Woodbridge loam, 0 to 8 percent slopes. Woodbridge loam, 8 to 15 percent slopes. Woodbridge very stony loam, 0 to 8 percent slopes. Woodbridge very stony loam, 8 to 15 percent slopes.	1½ to 2 feet of loam over a fine sandy loam pan layer; developed on the lower slopes and nearly level crests of drumlins in glacial till derived from schist, gneiss and granite; on hillsides water flows downslope above the pan layer and causes seeps; stones and boulders throughout the profile.	3+	1½	0 to 26 26 to 33+

[1] Based on total material. Data corrected for material from 3 to 10 inches in diameter.

significant to engineering—Continued

Classification		Percentage passing —[1]				Permeability	Available water capacity	Shrink-swell potential
Unified	AASHO	3-inch sieve	No. 4 sieve (4.7 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)			
							Inches per inch of depth	
SM, SP	A-1, A-2	85 to 100	75 to 90	60 to 80	5 to 30	Rapid	0. 08 to 0. 13	Low.
SM	A-2	90 to 100	60 to 95	50 to 95	10 to 30	Rapid	0. 08 to 0. 13	Low.
SM, SP	A-2, A-1, A-3	90 to 100	60 to 95	40 to 85	0 to 15	Very rapid	0. 05 to 0. 08	Low to none.
SM, SP	A-1, A-2, A-3.	100	75 to 100	60 to 100	0 to 20	Very rapid	0. 08 to 0. 10	Low to none.
SM, SP-SM	A-2	100	100	100	10 to 25	Very rapid	0. 08 to 0. 10	Low to none.
SM, SP	A-2, A-3, A-1.	100	100	90 to 100	0 to 25	Very rapid	0. 05 to 0. 08	Low to none.
SM	A-4	85 to 100	85 to 100	85 to 95	40 to 50	Moderate	0. 13 to 0. 17	Low.
SM	A-4, A-2	90 to 100	90 to 100	85 to 95	25 to 50	Slow	0. 05 to 0. 08	Low.

TABLE 7.—*Interpretation*

Soil series and map symbols [1]	Susceptibility to frost action	Suitability as source of— Topsoil [2]	Sand	Gravel	Road fill	Soil features affecting— Highway location
Acton (AcB, AdB, AdC)	High	Fair	Not suitable.	Not suitable.	Fair	Stoniness; very high water table; seepage along compact layer in cut slopes.
Agawam (AfA, AfB)	Low to moderate.	Good	Poor below 3 to 5 feet; sand above not suitable.	Not suitable.	Fair to good; erodible.	High erodibility
Au Gres (AgA, AgB, AuB)	High	Fair	Poor	Poor to not suitable.	Fair to good; erodible.	High water table; subject to sloughing in cuts and ditches.
Belgrade (BcB)	High	Good	Not suitable.	Not suitable.	Poor; highly erodible; not easily workable.	High water table; low bearing capacity.
Canaan-Hermon (CaC, CaD, ChD, ChE).	Low to moderate.	Poor	Not suitable.	Not suitable.	Poor; shallow.	Bedrock at 2½ feet; possible seepage over bedrock.
Colton (CoA, CoB, CoC, CtE)	Not susceptible.	Not suitable.	Good	Good for subbase and base course.	Good	Difficulty of establishing plants on cuts and fills.
Duane (DuB)	Moderate	Good	Fair to good; high water table.	Fair to good; high water table.	Good	Fluctuating high water table
Gloucester (GcB, GcC, GcD, GrB, GrC, GrD, GrE, GsD, GsE).	Low	Fair	Poor to not suitable.	Not suitable.	Good	Stoniness
Hermon (HmB, HmC, HmD, HnB, HnC, HnD, HoD, HoE).	Low	Fair	Poor to not suitable.	Not suitable.	Good	Stoniness
Hinckley (HrE, HsA, HsB, HsC)	Not susceptible.	Not suitable.	Good	Good for subbase and base course.	Good	Difficulty of establishing plants on cuts and fills.
Limerick (Lm)	High	Fair	Not suitable.	Not suitable.	Poor; highly erodible; not easily workable.	High water table; erodibility; low bearing capacity.
Marsh (Mh)	High	Not suitable.	Not suitable.	Not suitable.	Not suitable.	High water table; high compressibility.

See footnotes at end of table.

of soils for engineering

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Rapid permeability and seasonally high water table; stoniness.	Moderate permeability.	Stony; impervious layer at 2 to 3 feet.	Seasonally high water table; low to moderate water-holding capacity after drainage.	Stoniness	Stoniness; seepage.
Rapid permeability	Moderate permeability when compacted; susceptible to piping.	Usually not required.	Moderate water-holding capacity.	Erodibility	Erodibility.
Seasonally high water table; rapid permeability.	Moderate permeability.	Ditchbanks subject to sloughing; impervious, cemented lenses.	High water table; usually not irrigated.	Layers of sand and gravel.	Subject to continuous flooding.
Occasional lenses of fine sand.	Moderately high shrink-swell potential; poor stability; susceptible to piping.	Slow internal drainage.	Low intake rate; seasonally high water table.	Erodibility	Erodibility.
Shallowness to bedrock.	Moderate permeability.	Shallowness to bedrock.	Shallowness to bedrock.	Shallowness to bedrock.	Shallowness to bedrock.
Very rapid permeability.	Very rapid permeability.	Usually not required.	Low water-holding capacity.	Layers of gravel	Difficulty of establishing plants.
Seasonally high water table; very rapid permeability.	Rapid permeability	Ditchbanks subject to sloughing.	Seasonally high water table; low to moderate water-holding capacity after drainage.	Layers of gravel	Layers of gravel.
Rapid permeability	Moderate permeability.	Usually not required.	Low to moderate water-holding capacity.	Stoniness	Stoniness.
Rapid permeability	Moderate permeability.	Usually not required.	Low to moderate water-holding capacity.	Stoniness	Stoniness.
Very rapid permeability.	Rapid permeability	Usually not required.	Low water-holding capacity.	Layers of gravel	Difficulty of establishing plants.
High water table	Moderately high shrink-swell potential; poor stability.	Slow internal drainage.	Low intake rate; high water table.	Erodibility	Erodibility; prolonged seepage.
Ponded most of year	Not suitable	Variable	Not irrigated	Does not apply	Does not apply.

TABLE 7.—*Interpretation of soils*

Soil series and map symbols [1]	Suscepti-bility to frost action	Suitability as source of—				Soil features affecting—
		Topsoil [2]	Sand	Gravel	Road fill	Highway location
Merrimac (MmA, MmB, MmC)	Low to not suscep-tible.	Fair to good	Good	Good sub-base and base course.	Good	Difficulty of establishing plants on cuts and fills.
Mixed alluvial land (Mn)	Variable	Fair	Not suit-able	Not suit-able.	Poor; vari-able.	High water table; compressi-bility.
Muck and Peat (Mp)	Variable	Not suit-able.	Not suit-able.	Not suit-able.	Not suit-able.	High water table; compressi-bility.
Ninigret (NnA)	High	Good	Not suit-able.	Not suit-able.	Poor to fair; erodible.	Fluctuating high water table; erodibility.
Ondawa (Of, Oh)	Moderate for high bottom; moderate to high for low bottom.	Good	Poor	Not suit-able.	Poor to fair; erodible.	Subject to flooding
Paxton (PaB, PaC, PaD, PnB, PnC, PnD, PnE).	High	Good	Not suit-able.	Not suit-able.	Fair	Stoniness; seepage along pan layer on cut slopes.
Podunk (Po)	High	Good	Poor	Not suit-able.	Poor to fair; erodible.	High water table; subject to flooding.
Ridgebury (RbA, RbB)	High	Fair	Not suit-able.	Not suit-able.	Fair	High water table; stoniness; seepage along pan layer on cut slopes.
Ridgebury and Whitman (RdA, RdB).	High	Poor	Not suit-able.	Not suit-able.	Fair to poor.	High water table; stoniness; pan layer at about 2 feet.
Riverwash (Rh)	Variable	Not suit-able.	Fair	Fair to good; variable.	Fair to good.	Subject to flooding; high water table.
Rock outcrop (Ro)	Does not apply.	Not suit-able.	Not suit-able.	Not suit-able.	Does not apply.	Bedrock at surface; seepage
Rumney (Ru)	High	Fair	Poor to not suitable.	Not suit-able.	Poor to fair; erodible.	Highwater table; subject to flooding; restricted drain-age outlets.
Saco (Sa)	High	Poor	Not suit-able.	Not suit-able.	Not suit-able to poor; erodible; not easily workable.	High water table; flooding; compressibility; restricted outlet for drainage.

See footnotes at end of table.

for engineering—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Very rapid permeability.	Rapid permeability	Usually not required	Low water-holding capacity.	Layers of gravel	Layers of gravel.
Variable	Variable	Variable	High water table; not usually irrigated.	Variable	Variable.
High water table	Not suitable	Variable	High water table; not usually irrigated.	Does not apply	Does not apply.
Rapid permeability; seasonally high water table.	Moderate permeability; susceptible to piping.	Ditch banks subject to sloughing; filters required for tile drainage.	Seasonally high water table; moderate water-holding capacity; erodible after drainage.	Erodibility	Erodibility.
Rapid permeability; subject to flooding.	Moderate permeability.	Subject to flooding	Moderate water-holding capacity; moderate intake rate.	Usually not required	Subject to flooding.
Pan layer at about 2 feet.	Slow permeability	Pan layer at about 2 feet; stony.	Pan layer at about 2 feet.	Stoniness	Stoniness; prolonged seepage.
High water table; subject to flooding.	Moderate permeability.	Surface flooding	Seasonally high water table; moderate water-holding capacity after drainage.	Usually not required	Subject to flooding.
Pan layer at about 2 feet; stony; high water table.	Slow permeability	Pan layer at about 2 feet; stony.	High water table; moderate water-holding capacity after drainage; pan layer at about 2 feet.	Stoniness	Stoniness; prolonged seepage.
Pan layer at about 2 feet; high water table.	Variable permeability.	Pan layer at about 2 feet; stoniness.	High water table; moderate water-holding capacity.	Stoniness	Stoniness; prolonged seepage.
Not suitable	Variable permeability.	Does not apply	Not irrigated	Does not apply	Does not apply.
Does not apply	Does not apply	Does not apply	Nor irrigated	Does not apply	Does not apply.
High water table surface flooding.	Moderate permeability.	Surface flooding; restricted outlet.	High water table; not usually irrigated.	Shallowness to bedrock.	Subject to flooding.
High water table; flooding.	Moderately high shrink-swell potential.	Surface flooding; restricted outlets.	Not usually irrigated.	Not usually required.	Subject to flooding.

TABLE 7. *Interpretation of soils*

Soil series and map symbols [1]	Suscepti-bility to frost action	Suitability as source of—				Soil features affecting—
		Topsoil [2]	Sand	Gravel	Road fill	Highway location
Scarboro (Sc)	High	Poor	Poor to not suitable; permanent high water table.	Not suitable to poor.	Not suitable to poor; erodible.	High water table; sloughing in cuts and ditches.
Shapleigh-Gloucester (SgB, SgC, ShC, ShD, SoD, SoE).	Low to moderate.	Poor	Not suitable.	Not suitable.	Poor; shallow.	Bedrock at 2½ feet; possible seepage over bedrock.
Sudbury (SuA, SuB)	Moderate	Good to fair.	Fair to good; high water table.	Fair to good; high water table.	Good	Fluctuating water table; subject to sloughing in cuts and ditches.
Suncook (Sy)	Low to moderate.	Poor	Fair to poor.	Not suitable.	Fair to good.	Erodibility; difficulty of establishing plants; subject to piping.
Windsor (WdA, WdB, WdC, WdE).	Low to not susceptible.	Poor	Poor to fair; good for sanding roads.	Not suitable	Fair; erodible; difficult to establish plants.	Erodible; difficulty of establishing plants.
Woodbridge (WoB, WoC, WvB, WvC).	High	Good	Not suitable.	Not suitable.	Fair	Stoniness; high water table; seepage above pan layer in cut slopes and on hillsides.

[1] Gravel pits and Made land vary, and no interpretations of these land types were made for engineering purposes.

Many soils, particularly those derived from glacial till, contain many large stones that interfere with the construction and finishing of earth structures. Frequently large rocks must be blasted before they can be removed. Soils that have a stony surface layer are indicated as very stony and extremely stony phases. In some places the stones and boulders have been removed from the surface but not from the lower part of the soil.

Another problem to be considered when planning construction on soils derived from glacial till is their shallowness to bedrock. Shallow soils, such as the Shapleigh-Gloucester and Canaan-Hermon, generally have bedrock at a depth of 24 inches or less. There may be many rock outcrops on these soils or almost none. In Merrimack County bedrock in most places must be removed by blasting. Rippers and similar equipment are not generally successful in loosening this rock.

The other soils in glacial till in Merrimack County generally are 24 inches deep, or more. Because of the scale used in mapping, small areas of shallow soil may not always be delineated on the map. Before planning work in these soils, the engineer should determine whether the depth to bedrock will affect the design or construction.

The reaction of most soils in the county is within the range of pH 5.1 to 6.0.

Soil features that affect soil and water conservation engineering and highway construction are discussed in the following paragraphs.

Soil and water conservation engineering.—The principal engineering structures built in this county to conserve soil and water are drainage systems, irrigation systems, farm ponds, diversion ditches, and waterways.

The Gloucester, Hermon, Paxton, Acton, Woodbridge, Ridgebury and Whitman, Canaan-Hermon, and Shapleigh-Gloucester soils were derived from glacial till and present special problems in conservation engineering because they contain many large stones and boulders and may be shallow to bedrock. The Acton, Paxton, Woodbridge, and Ridgebury soils are underlain by a compact, platy substratum that retards the downward movement of water. This should be considered when planning and installing irrigation or drainage systems. The compact substratum, however, makes these soils good sites for farm ponds.

The soils developed in glaciofluvial deposits and stream terraces include the Hinckley, Colton, Merrimac, Windsor, Sudbury, Duane, Au Gres, Scarboro, Agawam, and Ninigret. These soils are made up of water-sorted materials, and as a rule, they tend to be coarse textured and very pervious.

for engineering—Continued

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
High water table	Moderate permeability; susceptible to piping.	Ditch subject to sloughing; filters required on tile drains.	High water table; not usually irrigated.	Erodibility	Erodibility; continuous flow.
Shallowness to bedrock.	Moderate permeability.	Shallowness to bedrock.	Shallowness to bedrock.	Shallowness to bedrock.	Shallowness to bedrock.
Seasonally high water table; permeable.	Rapid permeability		Seasonally high water table; low to moderate water-holding capacity after drainage.	Layers of gravel	Layers of gravel.
Very rapid permeability.	Rapid permeability	Not usually required.	Low water-holding capacity.	Not usually required.	Difficulty of establishing plants.
Very rapid permeability.	Rapid permeability	Not usually required.	Low water-holding capacity.	Erodibility	Erodibility; difficulty of establishing plants.
Pan layer at about 2 feet; seasonally high water table; stoniness.	Slow permeability	Pan layer at about 2 feet; stoniness.	Seasonally high water table; pan layer at about 2 feet.	Stoniness	Stoniness; prolonged seepage.

[2] Suitability as source of topsoil depends on amount of gravel and stones; rating is for nonstony soil.

Farm ponds planned to store water above the original ground line ordinarily are not built on these soils. If they are built, a sealing agent should be used to prevent seepage from the reservoir. In places where the water table is near the surface, dugout ponds extending below the water table are successful. In dugout ponds the water level fluctuates with the water table, but in most places the rate of ground water recharge is high.

These soils are easily drained. Care is needed to protect layers of loose, ungraded silt, fine sand, or sand because these materials are subject to erosion, sloughing, and slumping. Subsurface-drainage systems installed in these layers must be provided with filters to keep soil material from flowing in and plugging the drains. Except for Agawam soils, the well-drained soils in glaciofluvial deposits and stream terraces tend to be droughty and to have a low water-holding capacity. This should be considered when planning irrigation systems for these soils and when growing plants for erosion control.

The Belgrade soils developed in glaciolacustrine silt and clay. Because they have slow internal drainage, these soils do not drain well through subsurface drains. Bedding, landshaping, and open ditches help to remove surface water.

Dugout ponds are successful on these soils. When planning pond dams, however, the high shrink-swell potential, low stability, and possible piping of these soils should be considered.

The Ondawa, Podunk, Rumney, Saco, and Suncook soils are on flood plains. The Suncook and Onadawa soils are well drained but are flooded periodically. The Podunk and Rumney soils are not so well drained and are flooded more often. The poorly drained Saco soil is flooded frequently. These wet soils are sometimes hard to drain because outlets are lacking. The Suncook is a droughty, coarse-textured soil that has a low water-holding capacity.

Highway work.—Bedrock may be exposed in deep cuts when highways are built in deep glacial till. In glacial till that is shallow to bedrock, the gradeline should be high enough to keep excavation of bedrock at a minimum. In this way also, the effect of seepage that occurs at the boundary of the soil and bedrock will be lessened or avoided. On these glacial soils, an adequate system for surface drainage and underdrainage should be provided, and coarse-grained soil materials should be used in the upper part of the subgrade.

Frost action is one of the main causes of soil engineering problems in the county. Soils may freeze to a depth of 5 feet or more. The soils most affected by frost action are

those that have a high or perched water table and those that have a high percentage of soil material that passes a No. 200 sieve. In general, a soil is not susceptible to frost action if less than 5 to 10 percent of the soil material passes a No. 200 sieve. Frost damage to pavements or structures depends upon the location of the gradeline in relation to the water table and surface of the ground. The susceptibility of the soils to frost action is shown in table 7. Such soils as the Ninigret, Limerick, and Belgrade are very susceptible.

It is usually desirable to suspend earthwork during winter to avoid using frozen materials, though it may not always be economically feasible. Work can continue in shallow soils or in soils that are made up of free-draining sandy and gravelly materials, but proper compaction control is required.

In some glacial soils, a compact, platy layer that is slowly permeable causes a perched water table or seepage. Soils in this group include the Paxton, Acton, Woodbridge, and Ridgebury. If roads are constructed on such soils, a survey is needed to determine the need for underdrainage. In highway cuts some underdrainage will be needed in roadway sections, but the requirements should be determined by field investigations.

Seepage in the back slope of roadcuts may cause the overlying material to slump or slide. If a perched water table or a compact layer that causes seepage is at a shallow depth below the pavement, freezing and saturation may cause a volume change. This decreases the bearing capacity of the saturated or thawed foundation and may cause the pavement to break. Pockets of wet, fine-grained soil in the foundation should be removed and replaced by coarser material.

Some glacial till consists of fine sand and silt that is susceptible to heaving. If such material occurs in the highway subgrade, it should be covered by a sufficient thickness of free-draining material to prevent detrimental heaving of the pavement. Frost heave can be prevented by mixing the fine-grained and coarse-grained material. Mixing helps to make heaving more uniform. Heaving can also be prevented by using a sufficient thickness of very permeable, sandy gravel or coarse sand in the upper part of the subgrade.

Soils developed in silt or clay, such as the Belgrade and Limerick, do not make good foundations because they are fine textured and have a water table that is near the surface. Roads over such soil should be built on embankments, and the gradeline should be kept several feet above the water table. If wet, fine-textured soil material is used in the subgrade or an embankment, the moisture content must be reduced so that it is at or slightly above the optimum. Otherwise, adequate compaction cannot be obtained.

Muck and Peat are not suitable as foundations for roads or other engineering structures, because they have low strength and high compressibility and normally have a high water table. They are also subject to subsidence and shrinkage, especially if drained. Roads should be alined to avoid deep Muck and Peat. If these organic materials occur within a cut section or an embankment site, they should be removed and replaced with coarse-grained material. Some very small areas of Muck and Peat are not shown on the soil map.

Construction of roads on stream terraces and alluvial bottoms ordinarily requires a minimum of earthwork except in places where the road ascends onto a high terrace into the uplands. The gradeline should be kept above the highest recorded flood in these areas.

Gravelly soils, if properly compacted, form a good subgrade for roads. Underdrainage may be needed if fine-textured soils underlie coarser material or if the cut reaches the underlying fine-grained material.

Road construction in glacial outwash generally requires somewhat less earthwork than construction in other material. Material from terraces, kames, and eskers may be used for surfacing secondary roads and in the base coarse of primary and secondary roads. Their use, however, requires close inspection.

Use of soils in the rural-urban fringe

Between the rural areas in the country and the built-up, urban areas is the rural-urban fringe. The spread of building from towns and cities toward the country has brought many land use changes in Merrimack County (fig. 10). In many places, former agricultural land is now a residential area, a motel site, a recreation center, or a shopping center. The urban sprawl onto agricultural land has created problems not only for the remaining farmers but also for the new occupants. Urbanization has left isolated fields too small to farm, and many other fields too close to residential areas for farming.

Houses in new developments are often built without considering the soil properties. In most places the new buildings are beyond the sewer lines, and a septic tank and field must be used for sewage disposal. The builder needs to know whether the soil is suitable for a septic tank.

In table 8 the soils are listed, and their permeability, depth to bedrock and water table, need for foundation drains, and other factors affecting their use and suitability for nonagricultural purposes are given.

Although the detailed soil map and the table serve as a guide for evaluating most soils, a detailed investigation at the site of the proposed construction is needed because as much as 15 percent of an area designated as a specific soil on the map may consist of areas of other soils too small to be shown on the published map. By comparing the soil description with the result of investigations at the site, the presence of an included soil can usually be determined.

The permeability data shown in table 8 are based on moist, undisturbed soil. Percolation tests made during dry seasons may show a higher rate of permeability. Because many soils in the county are in sandy and bouldery glacial till, they have rapid or very rapid permeability. These soils are generally well suited for septic tanks and can absorb a large volume of effluent. Other conditions, however, affect the use of septic tanks. Au Gres soils are rapidly permeable when drained, but septic tanks cannot function properly on these soils unless the water table is lowered. Soils in the Canaan-Hermon complex are rapidly permeable, but bedrock is near the

surface and makes them poor or not suitable. Limerick soils contain so much silt and clay that permeability remains slow even after the water table is lowered. The Paxton, Ridgebury, and Woodbridge soils are moderately permeable in the upper 2 feet but have a dense, slowly permeable pan layer. Their suitability for septic tanks, depends on the depth and permeability of the pan.

Serious trouble is caused in soils that have a very high water table only at certain times. If the water table moves up near the surface, it saturates the septic field and causes it to function improperly or not at all. Also, ground water may seep into excavations and hinder construction or may cause basement walls or foundations to be wet continuously, even though foundation drains have been provided.

Shallowness to bedrock is not a problem on many soils in Merrimack County, but glacial boulders of various sizes occur, and use of extra heavy equipment, blasting, and other time-consuming methods of excavation and grading are sometimes necessary. The Canaan-Hermon and Shapleigh-Gloucester soils, and areas designated as Rock outcrop (Ro) on the soil map have bedrock within 2 feet of the surface. Rock at such a shallow depth can increase excavation costs for basements and public utilities or interfere with septic tank effluent.

Susceptibility to frost heave action on specific soils is indicated in table 8. Many soils in the county are highly susceptible to frost damage caused by heaving. The effect of frost on roadbuilding is discussed more fully in the subsection "Engineering Interpretations of Soils." Heaving should also be considered in selecting building sites, because wet soils are likely to freeze every winter. Lenses of ice may cause porch floors or driveways to heave and crack. Builders can add coarse-grained materials to the subbase or take other precautions to prevent heaving.

Figure 10.—**In rural-urban area, owner has planted trees and built a pond to improve land use.**

TABLE 8.—*Interpretation of*

[Dashes indicate information does not apply. The effect of

Soil series and brief descriptions	Factors affecting general use				Factors affecting use for building sites
	Permeability	Depth to seasonally high water table	Depth to bedrock	Susceptibility to frost action	Excavation and grading
		Feet	*Feet*		
Acton (AcB, AdB, AdC): Moist, sandy soils underlain by sand, silt, clay, gravel, stones, and boulders; may have a pan layer at 30 inches.	Rapid above 34 inches; slow below.	1½	3+	High	Stones and boulders; seasonally high water table.
Agawam (AfA, AfB): Deep, very fine sand and silt soils underlain by loose, fine sand; little or no gravel.	Rapid	5+	5+	Low to moderate.	No problems
Au Gres (AgA, AgB, AuB): Wet, sandy soils underlain by coarse sand and gravel; a discontinuous cemented sandy layer at a depth of about 2 feet.	Rapid	0	5+	High	Extreme wetness
Belgrade (BcB): Moist, silty soils underlain by clay and fine sand.	Moderate above 17 inches; slow below.	1½	5+	High	High water table in spring and fall.
Canaan-Hermon (Canaan component) (CaC, CaD, ChD, ChE): Sandy soils; bedrock within 24 inches of the surface.	Rapid	0 to 2	0 to 2	Low to moderate.	Shallow to bedrock
Colton (CoA, CoB, CoC, CtE): Sandy soils underlain at 18 to 24 inches by sand and gravel.	Very rapid	5+	5+	Not susceptible.	Gravel and cobbles
Duane (DuB): Moist sandy soil underlain at 18 to 24 inches by sand and gravel.	Rapid above 15 inches; very rapid below.	1½	5+	Moderate	Seasonally high water table.
Gloucester (GcB, GcC, GcD, GrB, GrC, GrD, GrE, GsD, GsE): Sandy soils underlain by sand, silt, clay, gravel, stones, and boulders.	Rapid	3+	3+	Low	Stones and boulders
Hermon (HmB, HmC, HmD, HnB, HnC, HnD, HoD, HoE): Sandy soils underlain by sand, silt, clay, stones, and boulders.	Rapid	3+	3+	Low	Stones and boulders
Hinckley (HrE, HsA, HsB, HsC): Deep, loose, sandy and gravelly soils	Very rapid	5+	5+	Not susceptible.	Gravel and cobbles
Limerick (Lm): Wet silty and clayey soils	Slow	0	5+	High	High water table
Made land (Ma): Soils moved in construction	Variable	Variable	Variable	Variable	Variable
Marsh (Mh): Organic soils; ponded with shallow water most of the time.	--	0	--	High	--

See footnotes at end of table.

the soils for nonagricultural use

steepness of slope on building sites is discussed in the text]

Factors affecting use for building sites—Continued	Suitability for—			Suitability as source of—	
Foundation drains	Septic tank systems [1]	Sanitary land fill	Lawns [2]	Sand	Gravel
Needed; seasonally high water table.	Seasonally high water table.	Fair to poor; stones, boulders, and seasonally high water table.	Fair	Not suitable	Not suitable.
Not needed; good drainage.	Good drainage	Good	Good	Poor; poorly graded fine sand.	Not suitable.
Needed; high water table.	High water table	Poor; high water table	Fair	Poor	Poor to not suitable.
Needed; seasonally high water table.	Slow permeability	Fair; seasonally high water table.	Good	Not suitable	Not suitable.
Usually needed; seepage above bedrock.	Shallow to bedrock in most places.	Poor; shallow to bedrock	Poor	Not suitable	Not suitable.
Not needed; good drainage.	Very rapid permeability; hazard to water supply.	Good	Not suitable	Good	Good.
Needed; seasonally high water table.	Seasonally high water table.	Fair; seasonally high water table.	Good	Fair to good; limited by high water table.	Fair to good; high water table.
Usually needed; mainly in spring.	Good drainage	Fair to poor; stones and boulders.	Fair	Poor to not suitable.	Not suitable.
Usually needed; mainly in spring.	Good drainage	Fair to poor; stones and boulders.	Fair	Poor to not suitable.	Not suitable.
Not needed; good drainage.	Very rapid permeability; hazard to water supply.	Good	Not suitable	Good	Good.
Needed; high water table	Slow permeability and high water table.	Poor; high water table	Fair	Not suitable	Not suitable.
Variable	Variable	Variable	Not suitable	Not suitable	Not suitable.
	Ponded most of the time.	Not suitable	Not suitable	Not suitable	Not suitable.

TABLE 8.—*Interpretation of the soils*

Soil series and brief descriptions	Factors affecting general use				Factors affecting use for building sites
	Permeability	Depth to seasonally high water table	Depth to bedrock	Susceptibility to frost action	Excavation and grading
		Feet	*Feet*		
Merrimac (MmA, MmB, MmC): Sandy soils underlain at 18 to 24 inches by sand and gravel.	Rapid above 16 inches; very rapid below.	5+	5+	Low to not susceptible.	Gravel
Mixed alluvial land (Mn): Stream deposited sand, silt, and gravel; extremely variable in texture; usually poorly drained; subject to flooding.	Variable	0	5+	Variable	Frequent flooding; high water table.
Muck and Peat (Mp): Organic matter more than 12 inches deep; not suitable for most rural-urban uses.	Variable	0	Variable	Variable	Does not support equipment; compressible; high water table.
Ninigret (NnA): Moist very fine sandy soils; little coarse sand or gravel.	Rapid	1½	5+	High	Seasonally high water table; sloughing.
Ondawa (Of): Sandy and silty soils subject to flooding.	Rapid	3+	5+	Moderate to high.	Subject to flooding
Ondawa, high bottom (Oh): Sandy and silty soils on high bottoms not subject to frequent flooding.	Rapid	5+	5+	Moderate	Loose sand; flooded occasionally.
Paxton (PaB, PaC, PaD, PnB, PnC, PnD, PnE): Loamy soils with pan layer at 2 feet. Stony in places.	Moderate above 2 feet; slow below.	2+	3+	High	Pan layer and stones
Podunk (Po): Moist sandy and silty soils subject to flooding.	Rapid	1½	5+	High	Subject to flooding; seasonally high water table.
Ridgebury (RbA, RbB): Wet, loamy soils with pan layer at 2 feet.	Moderate above 2 feet; slow below.	0	3+	High	Extreme wetness; pan layer and stones.
Ridgebury and Whitman (Whitman component) (RdA, RdB): Wet and very wet stony soils	Moderate above 2 feet; slow below.	0	3+	High	Extreme wetness; stones and pan layer.
Riverwash (Rh): Sand, gravel, and cobbly deposits adjacent to streams.	Very rapid	0	5+	Variable	High water table
Rock outcrop (Ro): Nearly bare bedrock; little or no soil; not suitable for most rural-urban uses.			0		Bedrock at surface
Rumney (Ru): Wet sandy and silty soils; subject to flooding.	Rapid	0	5+	High	Flooding; high water table.

See footnotes at end of table.

for nonagricultural use—Continued

Factors affecting use for building sites—Continued	Suitability for—			Suitability as source of—	
Foundation drains	Septic tank systems [1]	Sanitary land fill	Lawns [2]	Sand	Gravel
Not needed; good drainage.	Very rapid permeability; hazard to water supply.	Good	Fair to good, depending on gravel content.	Good	Good.
	Subject to flooding; waterlogged most of the time.	Not suitable	Fair	Not suitable	Not suitable.
	Subject to frequent flooding; waterlogged.	Not suitable	Not suitable	Not suitable	Not suitable.
Needed; seasonally high water table.	Seasonally high water table.	Fair; wet in spring and fall.	Good	Not suitable	Not suitable.
Needed; water table near.	Subject to flooding	Not suitable; pollution hazard.	Good	Poor; poorly graded fine sand.	Not suitable.
Usually needed; water table near.	Subject to occasional flooding.	Generally not suitable; too shallow.	Good	Poor; poorly graded fine sand.	Not suitable.
Needed; seasonally high water table.	Slow permeability	Poor; pan layer and stones.	Good	Not suitable	Not suitable.
Needed; high water table.	Subject to flooding; seasonally high water table.	Poor; subject to flooding; pollution hazard.	Good	Poor	Not suitable.
Needed; high water table.	Slow permeability; high water table.	Poor; pan layer, stones, and high water table.	Fair	Not suitable	Not suitable.
Needed; high water table.	High water table; stones.	Poor; high water table, stones, and pan layer.	Poor	Not suitable	Not suitable.
	Subject to flooding; high water table; stony and cobbly.	Poor; subject to flooding; pollution hazard.	Not suitable	Fair	Fair to good.
	Little or no soil; nearly bare bedrock.	Poor; little or no soil	Not suitable	Not suitable	Not suitable.
Needed; high water table.	Subject to flooding; high water table.	Poor; flooding, pollution hazards, and high water table.	Fair	Poor to not suitable.	Not suitable.

TABLE 8.—*Interpretation of the soils*

Soil series and brief descriptions	Factors affecting general use				Factors affecting use for building sites
	Permeability	Depth to seasonally high water table	Depth to bedrock	Susceptibility to frost action	Excavation and grading
		Feet	*Feet*		
Saco (Sa): Very wet silty soils frequently flooded; not suitable for most rural-urban uses.	Slow	0	5+	High	Flooding; high water table.
Scarboro (Sc): Very wet waterlogged sandy soils	Rapid	0	5+	High	High water table; sloughing.
Shapleigh-Gloucester (Shapleigh component) (SgB, SgC, ShC, ShD, SoD, SoE): Sandy soils; bedrock within 24 inches of the surface.	Rapid	0 to 2	0 to 2	Low to moderate.	Bedrock at 0 to 2 feet
Sudbury (SuA, SuB): Moist sandy soil underlain at 18 to 24 inches by sand and gravel.	Rapid above 1½ feet; very rapid below.	1½	5+	Moderate	Seasonally high water table.
Suncook (Sy): Sandy soils on flood plains; subject to occasional flooding.	Very rapid	3+	5+	Low to moderate.	Deep, loose sand
Windsor (WdA, WdB, WdC, WdE): Deep, loose sandy soils; little or no gravel.	Very rapid	5+	5+	Low to not susceptible.	Deep, loose sand
Woodbridge (WoB, WoC, WvB, WvC): Moist loamy soils; pan layer at 2 feet	Moderate above 2 feet; slow below.	1½	3+	High	Pan layer, stones, seasonally high water table.

[1] Soils rated fair or poor require detailed investigation and need more complex sewage disposal systems.

The suitability of the soils for establishing lawns, and the probable sources of sand and gravel suitable for construction work are also shown in table 8. Both the quality and quantity of soil and gravel were considered in estimating their suitability. The estimated suitability of the soils for lawns is mainly on the basis of depth, texture, organic-matter content, and amount of coarse gravel or cobbles in the surface layer of the undisturbed soil. The ratings do not apply to areas where the surface soil and subsoil have been mixed by bulldozers. Thus, a rating of *good* means that the soil provides a good source of topsoil for removal and transfer to another area, or the surface soil in place is a good medium for establishing lawns. A few of the soil series shown in table 8 contain phases that are stony or bouldery on the surface and some that have had the stones and boulders removed. The ratings, however, are for soils from which stones and boulders have been removed. For information about soils with stones and boulders on the surface, see the section "Descriptions of the Soils."

Some soils that are suitable for both agricultural and nonagricultural uses are subject to periodic flooding. This hazard often precludes their use as residential or industrial sites. In addition to destruction by floodwater, such soils are commonly subject to pollution and contamination from flooded septic fields or other sewage disposal systems. For this reason, sites for sanitary land fill should not be on soils subject to flooding. If flooding is a problem, it is listed in the brief descriptions of soils series in table 8 and in the columns where it limits specific uses. The probable frequency of flooding on specific soils is discussed in more detail in the section "Descriptions of the Soils."

Data on the effect of slope on building sites is not given in table 8. As a general rule, however, soils on slopes steeper than about 15 percent require more excavating and grading than those on more gentle slopes. Susceptibility to slippage and erosion at building sites increases with steepness, especially if all vegetation is removed from the surface during construction. Newly seeded lawns on steeper slopes require special protection against erosion. Effluent from septic tanks is more likely to reach the surface of soils on strong slopes, which are underlain by a pan or by bedrock at a shallow depth. Popularity of hillside sites for homes, however, is increasing. Because the ratings in table 8 are generalized for soils of the same series, users of the table should also read the description of specific soils in the section "Descriptions of the Soils". In

for nonagricultural use—Continued

Factors affecting use for building sites—Continued	Suitability for—			Suitability as source of—	
Foundation drains	Septic tank systems [1]	Sanitary land fill	Lawns [2]	Sand	Gravel
------------------------	Subject to flooding; high water table.	Poor; flooding, pollution hazard, and high water table.	Poor	Not suitable	Not suitable.
Needed; high water table.	Subject to ponding; high water table.	Poor; high water table	Poor	Poor to not suitable.	Not suitable to poor.
Usually needed; seepage above bedrock.	Shallow to bedrock	Poor; shallow to bedrock	Poor	Not suitable	Not suitable.
Needed; seasonally high water table.	Seasonally high water table.	Fair; seasonally high water table.	Good to fair	Fair to good; high water table.	Fair to good; high water table.
Usually needed; water table near.	Subject to occasional flooding.	Poor; flooding and pollution hazard.	Poor	Fair to poor; poorly graded fine sand.	Not suitable.
Not needed; good drainage.	Very rapid permeability; hazard to water supply.	Good	Poor	Poor to fair; poorly graded fine sand.	Not suitable.
Needed; seasonally high water table.	Slow permeability; seasonally high water table.	Poor; stones, pan layer; seasonally high water table.	Good	Not suitable	Not suitable.

[2] Ratings for lawns are based on the surface layer of nonstony soil types within the series.

this section the range in slope is given for each soil, and the intensity of the problems noted in table 8 can be determined.

Engineers and contractors will find more specific information about the soils in the section "Engineering Properties of the Soils," which was prepared especially for engineers and other builders.

Use of soils for recreation

Much of Merrimack County has soils well suited to temporary and permanent campsites, picnic areas, playgrounds, golf courses, skiing areas, and hunting grounds. In this report, suitability of the soils for specific kinds of recreational facilities has not been estimated because of environmental factors and existing laws or regulations that may preclude such use. Some soils are suitable for campsites and picnic areas, but access to roads, lakes, sources of drinking water, or emergency services are poor. Many of the well-drained and excessively drained soils on stream terraces are too droughty for crops but are suitable for playgrounds. Selection of sites for playgrounds, however, depends mainly on the distance from urban centers. Golf courses generally involve a large tract of land and many kinds of soils. The site must be determined on the basis of drainage and topography. Selection of sites for skiing depends on elevation, configuration and aspect of slopes, distribution and size of stones or boulders, drainage, access to all-weather roads, and other things. Use of the soil for wildlife is discussed elsewhere in the report.

The soil descriptions and interpretive tables in this report can be used to determine suitability of the soils for many recreational uses. Close observation of the soil map will provide additional information concerning the proximity of specific sites to lakes, roads, communities, and other necessary facilities.

Descriptions of the Soils

In this section, the soil series are described in alphabetic order. After each series, the soils of that series that were mapped in the county are described. An important part of each soil description is the soil profile, a record of what the soil scientist saw and learned when he dug into the ground. Since all the soils in one series have essentially the same profile, except for differences in texture of the surface layer, it is not necessary to describe the profile of every soil. The profile is therefore described for a

typical soil in each series. The reader can assume that all other soils in the series have essentially the same kind of profile. To illustrate, a detailed profile is described for Acton fine sandy loam, 0 to 8 percent slopes, and the reader is to conclude that all soils in the Acton series have essentially this kind of profile. The differences, if any, are indicated in the soil name, or mentioned in describing the particular soil.

The profile description is in smaller type than the rest of the description of the soil. Those who want to have only a working knowledge of the soil and its management need read only the part set in the larger print.

In describing the soils, the scientist frequently assigns a letter symbol, for example, "A1," to the various layers. These letter symbols have special meanings that concern scientists and others who desire to make a special study

TABLE 9.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Acton fine sandy loam, 0 to 8 percent slopes	2, 037	0. 3
Acton very stony fine sandy loam, 0 to 8 percent slopes	2, 869	. 5
Acton very stony fine sandy loam, 8 to 15 percent slopes	1, 526	. 3
Agawam very fine sandy loam, 0 to 3 percent slopes	920	. 2
Agawam very fine sandy loam, 3 to 8 percent slopes	1, 321	. 2
Au Gres fine sandy loam, 0 to 3 percent slopes	873	. 1
Au Gres fine sandy loam, 3 to 8 percent slopes	655	. 1
Au Gres loamy sand, 0 to 8 percent slopes	3, 121	. 5
Belgrade silt loam, 0 to 8 percent slopes	253	(1)
Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes	1, 290	. 2
Canaan-Hermon very rocky sandy loams, 15 to 25 percent slopes	283	. 1
Canaan-Hermon extremely rocky sandy loams, 8 to 25 percent slopes	1, 918	. 3
Canaan-Hermon extremely rocky sandy loams, 25 to 60 percent slopes	597	. 1
Colton loamy sand, 0 to 3 percent slopes	509	. 1
Colton loamy sand, 3 to 8 percent slopes	1, 840	. 3
Colton loamy sand, 8 to 15 percent slopes	734	. 1
Colton gravelly loamy sand, 15 to 60 percent slopes	1, 392	. 2
Duane fine sandy loam, 0 to 8 percent slopes	857	. 1
Gloucester sandy loam, 3 to 8 percent slopes	7, 660	1. 3
Gloucester sandy loam, 8 to 15 percent slopes	4, 635	. 8
Gloucester sandy loam, 15 to 25 percent slopes	1, 619	. 3
Gloucester very stony sandy loam, 3 to 8 percent slopes	19, 920	3. 4
Gloucester very stony sandy loam, 8 to 15 percent slopes	23, 350	3. 9
Gloucester very stony sandy loam, 15 to 25 percent slopes	5, 609	. 9
Gloucester very stony sandy loam, 25 to 60 percent slopes	1, 700	. 3
Gloucester extremely stony sandy loam, 8 to 25 percent slopes	193, 800	32. 6
Gloucester extremely stony sandy loam, 25 to 60 percent slopes	26, 100	4. 4
Gravel pits	3, 801	. 6
Hermon sandy loam, 3 to 8 percent slopes	1, 725	. 3
Hermon sandy loam, 8 to 15 percent slopes	1, 042	. 2
Hermon sandy loam, 15 to 25 percent slopes	564	. 1
Hermon very stony sandy loam, 3 to 8 percent slopes	4, 489	. 8
Hermon very stony sandy loam, 8 to 15 percent slopes	5, 260	. 9
Hermon very stony sandy loam, 15 to 25 percent slopes	1, 260	. 2
Hermon extremely stony sandy loam, 8 to 25 percent slopes	41, 961	7. 1
Hermon extremely stony sandy loam, 25 to 60 percent slopes	6, 473	1. 1
Hinckley gravelly loamy sand, 15 to 60 percent slopes	6, 190	1. 0
Hinckley loamy sand, 0 to 3 percent slopes	2, 260	. 4
Hinckley loamy sand, 3 to 8 percent slopes	8, 160	1. 4
Hinckley loamy sand, 8 to 15 percent slopes	3, 257	0. 5
Limerick silt loam, high bottom	393	. 1
Made land	1, 100	. 2
Marsh	1, 109	. 2
Merrimac sandy loam, 0 to 3 percent slopes	3, 350	. 6
Merrimac sandy loam, 3 to 8 percent slopes	11, 100	1. 9
Merrimac sandy loam, 8 to 15 percent slopes	6, 390	1. 1
Mixed alluvial land	3, 340	. 6
Muck and Peat	10, 900	1. 8
Ninigret very fine sandy loam, 0 to 3 percent slopes	376	. 1
Ondawa fine sandy loam	5, 290	. 9
Ondawa fine sandy loam, high bottom	2, 660	. 4
Paxton loam, 0 to 8 percent slopes	17, 400	2. 9
Paxton loam, 8 to 15 percent slopes	10, 580	1. 8
Paxton loam, 15 to 25 percent slopes	2, 850	. 5
Paxton very stony loam, 3 to 8 percent slopes	11, 275	1. 9
Paxton very stony loam, 8 to 15 percent slopes	19, 300	3. 3
Paxton very stony loam, 15 to 25 percent slopes	4, 930	. 8
Paxton very stony loam, 25 to 60 percent slopes	2, 800	. 5
Podunk fine sandy loam	2, 663	. 4
Ridgebury loam, 0 to 3 percent slopes	889	. 2
Ridgebury loam, 3 to 8 percent slopes	459	. 1
Ridgebury and Whitman very stony loams, 0 to 3 percent slopes	14, 520	2. 4
Ridgebury and Whitman very stony loams, 3 to 8 percent slopes	5, 515	. 9
Riverwash	267	(1)
Rock outcrop	242	(1)
Rumney fine sandy loam	2, 430	. 4
Saco silt loam	2, 482	. 4
Scarboro fine sandy loam	2, 279	. 4
Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes	1, 262	. 2
Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes	729	. 1
Shapleigh-Gloucester very rocky sandy loams, 3 to 15 percent slopes	5, 720	1. 0
Shapleigh-Gloucester very rocky sandy loams, 15 to 25 percent slopes	1, 257	. 2
Shapleigh-Gloucester extremely rocky sandy loams, 8 to 25 percent slopes	8, 500	1. 5
Shapleigh-Gloucester extremely rocky sandy loams, 25 to 60 percent slopes	2, 650	. 4
Sudbury fine sandy loam, 0 to 3 percent slopes	1, 460	. 2
Sudbury fine sandy loam, 3 to 8 percent slopes	2, 341	. 4
Suncook loamy sand	2, 617	. 4
Windsor loamy sand, 0 to 3 percent slopes	1, 499	. 3
Windsor loamy sand, 3 to 8 percent slopes	3, 299	. 6
Windsor loamy sand, 8 to 15 percent slopes	3, 210	. 5
Windsor loamy sand, 15 to 60 percent slopes	1, 399	. 2
Woodbridge loam, 0 to 8 percent slopes	3, 640	. 6
Woodbridge loam, 8 to 15 percent slopes	522	. 1
Woodbridge very stony loam, 0 to 8 percent slopes	6, 001	1. 0
Woodbridge very stony loam, 8 to 15 percent slopes	2, 335	. 4
Water (bodies less than 40 acres in size)	5, 400	. 9
Total	594, 560	100. 0

[1] Less than 0.1 percent.

of soils. Most readers need to remember only that all letter symbols beginning with "A" refer to surface soil and subsurface soil; those beginning with "B" refer to subsoil; and those beginning with "C" refer to substratum, or parent material. It may be helpful to remember that the small letter "p" indicates a plowed layer and that the small letters "ir" indicate an accumulation of iron.

Soil scientists use Munsell notations to indicate the color of a soil precisely, and they provide the equivalent in words for those not familiar with the system. They compare a sample of soil with a standard color chart. The Munsell notation, and its less exact approximation in words, are read from the chart; for example "dark brown (10YR 3/3)." In the example given, "10YR" is the hue, and "3/3" expresses the value and chroma. The notation "10YR 3/3" is more exact than the words "dark brown." The color was observed when the soil was moist unless stated otherwise, and the word "moist" is omitted.

The texture of the soil refers to the content of sand, silt, and clay. It is determined by the way the soil feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural name, such as "fine sandy loam." This refers to the texture of the surface layer.

Structure is indicated by the way the individual soil particles are arranged in larger grains, or aggregates, and the amount of pore space between the grains. The structure of the soil is determined by strength, or grade, the size, and the shape of the aggregates. For example, a horizon may have "weak, fine, granular structure."

Consistence refers to the feel of the soil when wet, moist, or dry. Other features, such as roots, stones, a pan layer, and the water table are also described.

Other technical terms are explained in the Glossary at the back of this report and in the "Soil Survey Manual" (7). The approximate acreage and proportionate extent of the soils are given in table 9, and their location can be seen on the detailed map at the back of the report. Also at the back of the report is a list of the soils mapped, along with the symbol of each and the capability unit and woodland suitability group to which each belongs.

Acton Series

In the Acton series are moderately well drained, level to moderately sloping, sandy soils in glacial till. Their native vegetation was red maple, red oak, white oak, hemlock, elm, and white pine. These soils formed on uplands in material derived from granite, gneiss, and schist. They occupy slight depressions and long, gently sloping to moderately sloping hillsides that receive seepage water from higher lying soils. Acton soils have a water table that is high in wet periods and low in dry periods.

The surface layer is dark-brown fine sandy loam. The subsoil is yellowish-brown sandy loam mottled with light brownish gray. The substratum is olive-gray gravelly loamy sand. It is friable in most places, but in some it is firm. The Acton soils are strongly acid.

The Acton soils are near the Gloucester, Shapleigh, and Ridgebury soils. They are similar to the Woodbridge soils but are sandier than these soils, and their pan layer, if present, is less compact. Acton soils have poorer drainage than the Gloucester soils. They are deeper to bedrock than the sandy Shapleigh soils. Acton soils are better drained than the poorly drained Ridgebury soils.

Water drains rapidly through Acton soils above the pan, and more slowly through the pan layer. These soils are wet early in spring, late in fall, in winter, and in rainy periods because of a high water table. During the growing season, however, these soils are generally moist and supply adequate moisture for plants. These soils must be worked later in spring than well-drained soils. Although most stones have been removed from the fields, a few are on the surface in places.

Typical profile of Acton fine sandy loam, 0 to 8 percent slopes—

Ap—0 to 7 inches, dark-brown (10YR 3/3) fine sandy loam; gravel 2 percent by volume and as much as one-fourth inch in diameter; weak, fine, granular structure; friable; many roots; strongly acid; boundary abrupt, wavy. 6 to 9 inches thick.

B21—7 to 11 inches, yellowish-brown (10YR 5/4) sandy loam; cobbles 5 percent by volume and 4 inches in diameter; weak, fine, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 0 to 5 inches thick.

B22—11 to 19 inches, dark yellowish-brown (10YR 4/4) sandy loam grading to loamy sand in the lower part; gravel 10 percent by volume and as much as one-fourth inch in diameter; weak, fine, granular structure; friable; roots common; strongly acid; boundary clear, wavy. 6 to 9 inches thick.

B31g—19 to 30 inches, light brownish-gray (2.5Y 6/2) fine gravelly loamy sand streaked with strong brown (7.5YR 5/6); gravel 20 percent by volume and ¼ to ½ inch in diameter; massive (structureless) but in places breaks to weak, thick, platy structure when disturbed; friable; few roots; strongly acid; boundary clear, wavy. 9 to 12 inches thick.

B32g—30 to 34 inches, light brownish-gray (2.5Y 6/2) fine gravelly coarse sand with streaks of strong brown (7.5YR 5/6); single grain (structureless); very friable; strongly acid; boundary abrupt, smooth. 3 to 4 inches thick.

C1—34 to 39 inches, olive-gray (5Y 5/2) fine gravelly loamy sand; weak, thick, platy structure; firm in place, friable when disturbed; strongly acid; boundary clear, wavy. 4 to 6 inches thick.

In most places the texture of the surface layer is fine sandy loam, but in some places it is sandy loam or loamy sand. Depth to the mottling or streaking varies, but the mottles are usually within 15 to 20 inches of the surface.

Acton fine sandy loam, 0 to 8 percent slopes (AcB).—This soil has a profile similar to the one described for the series. It is a level to gently sloping soil in slight depressions, on long gently sloping hillsides, and at the base of slopes. In a few places the slopes are somewhat shorter and steeper than normal. Stones have been removed from the surface to permit the use of modern farm equipment. The erosion hazard is moderate.

Included in mapped areas of this soil are areas that have a firm pan layer at a depth below 30 inches.

This soil is suitable for cultivated crops, hay, and pasture. On long slopes, crops should be arranged in strips having a slight gradient so that water can drain from rows. Diversion ditches are used to control runoff on these slopes. On the more gentle slopes, artificial drainage is needed to increase the kinds of crops that can be grown and to allow earlier working of the soil after rains. (Capability unit IIw-52; woodland suitability group 1)

Acton very stony fine sandy loam, 0 to 8 percent slopes (AdB).—Except for a greater number of stones on its surface, this soil is similar to Acton fine sandy loam,

0 to 8 percent slopes. This level to gently sloping soil occurs on uplands in slight depressions, on gently sloping hillsides, and at the base of slopes.

Included in mapped areas of this soil are areas that have a pan layer at a depth below 30 inches.

Enough stones are on the surface to prevent the use of modern farm equipment and to limit the use of this soil to pasture or to woodland. (Capability unit VIs-72; woodland suitability group 1)

Acton very stony fine sandy loam, 8 to 15 percent slopes (AdC).—This soil is more sloping and has more stones on its surface than Acton fine sandy loam, 0 to 8 percent slopes. It occurs on the side of hills on uplands. Seeps occur where water moves downslope through the soil and comes to the surface.

Included in areas mapped as this soil are areas that have a pan layer at a depth below 30 inches. Also included are small areas of Acton very stony fine sandy loam that have slopes greater than 15 percent.

Enough stones are on the surface of this soil to prevent the use of modern farm equipment and to limit use to permanent pasture or to woodland. (Capability unit VIs-72; woodland suitability group 1)

Agawam Series

In the Agawam series are nearly level to gently sloping, deep, well-drained, medium-textured soils on stream terraces. They formed under native forest consisting of white pine and red oak and other hardwoods. These soils contain no gravel or stones. Their water-sorted parent material was derived from schist, granite, and gneiss.

The surface layer is dark-brown very fine sandy loam; the subsoil is yellowish-brown fine sandy loam; and the material below the subsoil is pale-brown to light-gray fine sand. The parent material is strongly acid to medium acid.

Agawam soils are finer textured than the sandy Windsor soils and the coarse-textured, gravelly Hinckley soils. They occur at higher elevations than the Ondawa soils and are seldom flooded.

Water drains through Agawam soils readily, but the fine particles hold enough water for plants. These soils are easily worked.

Typical profile of Agawam very fine sandy loam, 0 to 3 percent slopes -

Ap—0 to 14 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; weak, medium, granular structure; very friable when moist; many roots; strongly acid; boundary clear, wavy. 14 to 16 inches thick.

B21—14 to 17 inches, yellowish-brown (10YR 5/6) very fine sandy loam; weak, medium, granular structure; very friable when moist; roots common; strongly acid; boundary clear, wavy. 2 to 3 inches thick.

B22—17 to 29 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, medium, granular structure; very friable when moist; roots common; medium acid; boundary clear, wavy. 11 to 12 inches thick.

C1—29 to 36 inches, light olive-brown (2.5Y 5/4) loamy fine sand; weak, medium, subangular blocky structure that breaks to single grain (structureless); very friable when moist; few roots; medium acid; boundary clear, wavy. 6 to 9 inches thick.

C2—36 to 45 inches, light yellowish-brown (2.5Y 6/4) loamy fine sand; weak, medium, subangular blocky structure that breaks to single grain (structureless); very friable when moist; medium acid; boundary clear, wavy. 12 to 17 inches thick.

The texture of the surface layer is very fine sandy loam in most places, but in a few it is fine sandy loam. Agawam soils are generally free of gravel to a depth of 3 feet or more, but in some places scattered gravel occurs.

Agawam very fine sandy loam, 0 to 3 percent slopes (AfA).—This soil has a profile similar to the one described for the series. It is nearly level and is subject to only slight erosion.

Included in mapped areas of this soil are soils that have a higher silt content.

This soil is suited to many crops, including small grain, hay, and pasture. It is especially well suited to truck crops. (Capability unit I-2; woodland suitability group 2)

Agawam very fine sandy loam, 3 to 8 percent slopes (AfB).—This soil is gently sloping but is otherwise similar to Agawam very fine sandy loam, 0 to 3 percent slopes. The erosion hazard is greater than on the less sloping soil.

Included in mapped areas of this soil are soils that have a higher silt content. Also included are small areas of Agawam very fine sandy loam with slopes greater than 8 percent.

Row crops, truck crops, hay, and pasture are well suited to this soil. Field strips, contour strips, and diversion ditches on the long slopes help to reduce erosion. Terraces are needed if vegetables are grown. (Capability unit IIe-2; woodland suitability group 2)

Au Gres Series

In the Au Gres series are strongly acid, somewhat poorly drained or poorly drained soils in depressions on nearly level sandy plains and on gently sloping stream terraces. Their native vegetation was red maple, white pine, speckled alder, and gray birch. They developed in water-sorted, sandy materials derived from granite, gneiss, and schist. The water table is within a few inches of the surface late in fall, in winter, and early in spring. In drier periods it is about 6 feet from the surface.

The surface layer is very dark gray loamy sand. A gray layer of medium sand is below the surface layer. This gray layer is underlain by darker layers of yellowish-brown and reddish-brown medium sand. These lower horizons are partly cemented by illuvial organic matter, or iron and organic matter. Cementation ranges from weak to moderate and in places is discontinuous, both horizontally and vertically. In dry periods the cemented layer is firm in place but is friable when disturbed; in wet periods it is less firm. The substrata are brownish-gray medium and coarse sand.

Au Gres soils are near Merrimac, Sudbury, Hinckley, Windsor, and Scarboro soils. They developed in sandy material similar to that of the Sudbury and Merrimac soils. They are poorly drained, in contrast to the moderately well drained Sudbury, the well-drained Merrimac, the excessively drained sandy and gravelly Hinckley, and the droughty, deep Windsor soils. Au Gres soils also are near the very poorly drained Scarboro soils.

Au Gres soils have a high water table in wet periods. If the water table is lowered, water moves rapidly through the upper sandy, porous layer, but movement through the partly cemented subsoil is moderate. Au Gres soils are fairly easy to work because they have no stones. They are often drained artificially.

Typical profile of Au Gres loamy sand, 0 to 8 percent slopes—

Ap—0 to 8 inches, very dark gray (10YR 3/1) loamy sand with many reddish-brown root stains along root channels; weak, fine, granular structure; very friable when moist; many roots; pH 5.0; boundary abrupt, smooth. 6 to 8 inches thick.

A2—8 to 10 inches, light-gray (10YR 6/1) sand; weak, fine, granular structure; very friable when moist; roots common; pH 5.2; boundary is abrupt and irregular and has tongues extending into the B21 horizon. 1 to 8 inches thick.

B21—10 to 12 inches, dark reddish-brown (5YR 3/2) loamy sand stained black and yellowish brown by organic matter; weak, fine, granular structure; friable when moist; roots common; pH 5.2; boundary clear, irregular. ½ inch to 2 inches thick.

B22gm—12 to 26 inches, light yellowish-brown (2.5Y 6/4) medium sand; common, medium, distinct, yellowish-red (5YR 4/8) mottles; discontinuous ortstein aggregates that are dark red (2.5YR 3/6) and firm to very firm; weak, thick, platy structure; firm in place, friable when disturbed; roots few; pH 5.4; boundary clear, wavy. 10 to 14 inches thick.

Cg—26 to 56 inches +, light brownish-gray (2.5Y 6/2) medium and coarse sand; common, medium, distinct, yellowish-red (5YR 4/8) mottles; massive in place, single grain when disturbed; very friable in place, loose when disturbed, pH 6.0.

The texture of the surface layer varies widely in the Au Gres soils; very fine sandy loam, fine sandy loam, sandy loam, loamy sand, and sand occur. However, loamy sand is the most common. The finer textured Au Gres soils are mostly in the valley of the Merrimack River. Au Gres soils that are near the Merrimac and Hinckley soils generally contain gravel. The thickness of the A2 layer ranges from less than 2 inches in some places to as much as 14 inches in others. The cemented layer may be absent or several inches thick, and it varies in firmness.

Au Gres fine sandy loam, 0 to 3 percent slopes (AgA).—This soil has a finer textured surface layer than Au Gres loamy sand, 0 to 8 percent slopes, and generally its subsoil is more prominently mottled. In most places the surface layer is fine sandy loam, but in a few areas it is very fine sandy loam or sandy loam.

This soil is best suited to hay because it is poorly drained. If it is drained, it can be used more intensively. Some areas are pastured when the soil is dry and firm enough that the feet of animals do not puncture the sod. The hazard of erosion is slight on this soil. (Capability unit IIIw-23; woodland suitability group 3)

Au Gres fine sandy loam, 3 to 8 percent slopes (AgB).—The surface layer of this soil is fine sandy loam, but some areas of very fine sandy loam and sandy loam were included in mapping. Mottling is generally more prominent in this soil than in Au Gres loamy sand, 0 to 8 percent slopes.

This soil is best suited to hay because it is poorly drained. Some areas are pastured when the soil is dry and firm enough to keep the feet of animals from puncturing the sod. The hazard of erosion is slight.

This soil can be used more intensively if it is drained. In most places drainage systems are easier to locate on this soil than on Au Gres fine sandy loam, 0 to 3 percent slopes. (Capability unit IIIw-23; woodland suitability group 3)

Au Gres loamy sand, 0 to 8 percent slopes (AuB).—This soil has a profile like the one described for the Au Gres series.

Because of poor drainage, this soil is best suited to hay. Some areas are pastured when the soil is dry and firm enough to keep the feet of animals from puncturing the sod. If artificial drainage is installed, the soil can be used more intensively. Ditchbanks, however, are more likely to slough than those in the Au Gres fine sandy loams. The erosion hazard is slight on this loamy soil, but ditchbanks may slough. (Capability unit IIIw-23; woodland suitability group 3)

Belgrade Series

In the Belgrade series are moderately well drained, medium-textured, strongly acid, silty soils in level to gently sloping, old glacial lakebeds. Their native vegetation was oak, red maple, white pine, and hemlock. These soils developed in deposits of varved (thinly stratified) silt, very fine sand, and clay, which settled and filled the glacial lake. They are not extensive but occur in some places along the major streams. A seasonally high water table keeps these soils wet early in spring, late in fall, and in winter.

The surface layer is dark-brown silt loam; the subsoil is dark yellowish-brown and light olive-brown silt loam; and the substratum is silt loam mottled with light olive brown and grayish brown.

The Belgrade soils occur near the poorly drained, silty and clayey Limerick soils. Belgrade soils are not so sandy as the nearby Ninigret soils but have the same natural drainage.

Water moves slowly through the lower layers of the Belgrade soils. These soils must be worked later in spring than well-drained soils because of their seasonally high water table. In dry periods an adequate amount of water is held available to plants. The Belgrade are among the finest textured soils in the county. They do not contain gravel or stones.

Typical profile of Belgrade silt loam, 0 to 8 percent slopes—

A1—0 to 3 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 1 to 3 inches thick.

B21—3 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 4 to 7 inches thick.

B22—7 to 17 inches, light olive-brown (2.5Y 5/4) silt loam; weak, medium, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 9 to 12 inches thick.

C1g—17 to 22 inches, light olive-brown (2.5Y 5/4) silt loam; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, thin, platy structure; friable to firm; many roots; strongly acid; boundary clear, wavy. 3 to 5 inches thick.

C2g—22 to 40 inches +, grayish-brown (2.5Y 5/2) silt loam; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, platy structure; friable to firm; few roots; yellowish-red (5YR 4/8) concretions about 1 inch in diameter; strongly acid.

The texture of the surface layer in most places is silt loam, but in a few it is very fine sandy loam. In some places lenses of silty clay and very fine sand occur below a depth of 2 feet. Layers of fine sand may occur at a depth of 5 feet. Mottling occurs at various depths, but it is generally within 12 to 17 inches of the surface.

Belgrade silt loam, 0 to 8 percent slopes (BcB).—This soil has a profile similar to the one described for the Belgrade series. The erosion hazard on this level to gently sloping soil is moderate to severe. However, the soil is suitable for cultivated crops, hay, and pasture. On long slopes, diversion ditches and graded strips are needed to help control runoff. (Capability unit IIw–32; woodland suitability group 2)

Canaan Series

The Canaan soils are not mapped separately in Merrimack County but in a complex with Hermon soils. They make up 70 percent of the area occupied by the complex. The Hermon soils are described under the Hermon series.

The Canaan are gently sloping to steep, somewhat excessively drained, shallow soils on hillsides and mountainsides in the northern part of the county. This part of the county generally receives more rainfall, has cooler temperatures, and is higher than the rest. The native vegetation consisted of sugar maple, beech, white birch, yellow birch, white pine, hemlock, and spruce.

The Canaan soils developed in glacial till derived from granite, gneiss, and schist. Stones and boulders occur throughout their profile. The outstanding characteristic of these soils is their shallowness to bedrock, which is generally granite but may be gneiss or schist. In many places bedrock crops out. Depth to bedrock ranges from 12 to 24 inches; the average is about 18 inches. These soils are very strongly acid.

The Canaan soils are not so deep as the Hermon soils. They developed where the soil material that covers the irregular and wavy boundary of the bedrock is thinner. The Hermon soils developed where it is thicker (more than 24 inches deep). Canaan soils are near the Acton, Ridgebury, and Colton soils. They are better drained than the moderately well drained, sandy Acton soils and the poorly drained Ridgebury soils. They are not so gravelly as the Colton soils. Canaan soils differ from the shallow Shapleigh soils in having a gray layer under the surface layer in most places and a subsoil that is dark reddish brown.

Water moves rapidly through these sandy soils. Because the soils are shallow, plants are damaged by lack of water in dry periods.

Typical profile of Canaan very rocky sandy loam, 3 to 15 percent slopes—

A00—2 inches to 1 inch, recent accumulation of leaves and pine needles.

A0—1 inch to 0, partly decomposed leaves and needles.

A2—0 to 2 inches, gray (10YR 5/1) sandy loam; weak, medium, granular structure; very friable; many roots; very strongly acid; boundary clear, wavy. 0 to 4 inches thick.

B21—2 to 7 inches, dark reddish-brown (2.5YR 3/4) sandy loam; weak, medium, granular structure; friable; many roots; very strongly acid; boundary clear, wavy 4 to 6 inches thick.

B22—7 to 15 inches, yellowish-red (5YR 4/6) sandy loam; weak, medium, granular structure; friable; roots common; strongly acid; boundary abrupt, wavy. 7 to 8 inches thick.

Dr—15 inches +, granite bedrock.

The gray layer immediately below the surface layer does not occur in all places. In some areas plowing or other disturbances have mixed this gray layer with other layers, but tongues of gray and dark reddish brown extend below plow depth. In most places the C horizon is thin, but in some it is absent. The texture of the surface layer in most places is sandy loam, but in a few it is fine sandy loam and loamy sand. In places where the soil has been plowed or otherwise disturbed, the color of the surface layer is dark brown or dark yellowish brown.

Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes (CaC).—A profile of the Canaan soil in this complex is described under the Canaan series; a profile of Hermon soil is described under the Hermon series. Included in mapped areas of this complex are small areas that are less rocky. Rock outcrops are so numerous in this complex that cultivation of crops is prevented. These soils can be used for permanent pasture and as woodland. (Capability unit VIs–57; woodland suitability group 6)

Canaan-Hermon very rocky sandy loams, 15 to 25 percent slopes (CaD).—Except that they are steeper, these soils are similar to Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes. Rock outcrops are so numerous that cultivation of crops is prevented. These soils are best suited to permanent pasture and woodland. Building access roads and logging are generally more difficult on these soils than on the less sloping soils. (Capability unit VIs–57; woodland suitability group 6)

Canaan-Hermon extremely rocky sandy loams, 8 to 25 percent slopes (ChD).—Except that they are more rocky and have slopes of as much as 25 percent, these soils are similar to Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes. These extremely rocky soils occur on hillsides and mountainsides. Rock outcrops are so numerous and the soils are so thin that areas of this complex are limited to woodland, wildlife, or recreation. In places small areas can be grazed. Because the soils are very thin, their moisture-holding capacity is low and tree growth is slow. (Capability unit VIIs–58; woodland suitability group 8)

Canaan-Hermon extremely rocky sandy loams, 25 to 60 percent slopes (ChE).—Except that they are much steeper and more rocky, the soils in this complex are similar to Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes. These are the steepest and rockiest soils mapped as a Canaan-Hermon complex. They occur on the roughest hillsides and mountainsides, and access to such areas is generally poor. Rock outcrops are so numerous and the soils are so thin that their use is limited to woodland, wildlife, or recreation. Because the soils are thin, their moisture-holding capacity is low and tree growth is slow. (Capability unit VIIs–58; woodland suitability group 8)

Colton Series

In the Colton series are excessively drained, strongly acid soils in water-sorted sand and gravel. Their native vegetation consisted of white pine, hemlock, spruce, fir, red maple, and red oak. They occur on outwash plains, terraces, kames, and eskers in material derived from granite, gneiss, and schist. The Colton soils occur in the northern part of the county. This part generally receives more moisture and has cooler temperatures and higher elevations than the rest of the county.

The surface layer of Colton soils is dark-brown or very dark brown loamy sand; in most places a gray layer is immediately below the surface layer. The upper part of the subsoil is dark reddish-brown gravelly loamy sand;

the lower part is yellowish-brown gravelly loamy sand. The substratum is brownish-yellow stratified sand and gravel.

The Colton soils are near the Hermon, Duane, and Au Gres soils. They are excessively drained, whereas the Hermon soils are well drained, the Duane soils are moderately well drained, and the Au Gres soils are poorly drained. The Colton soils differ from the water-sorted, sandy and gravelly Merrimac and Hinckley soils in having a gray layer below the surface layer and a dark reddish-brown subsoil.

Water moves very rapidly through these open, loose soils. The soils are droughty and hold very little moisture available for plants. Generally, they have no stones that interfere with tillage. As Colton soils are a good source of sand and gravel, they have many gravel pits.

Typical profile of Colton loamy sand, 3 to 8 percent slopes—

- Ap—0 to 8 inches, dark-brown (10YR 2/2) loamy sand; fine gravel about 4 percent by volume and as much as one-half inch in diameter; weak, fine, granular structure; very friable; many roots; very strongly acid; boundary abrupt, wavy. 6 to 8 inches thick.
- B21ir—8 to 12 inches, dark reddish-brown (2.5YR 3/4) gravelly loamy sand; weak, medium, granular structure; very friable; many roots; very strongly acid; boundary clear, wavy. 3 to 4 inches thick.
- B22—12 to 24 inches, yellowish-brown (10YR 5/8) gravelly loamy sand; weak, fine, granular structure; very friable; few roots; strongly acid; boundary clear, wavy. 10 to 12 inches thick.
- D—24 to 50 inches, brownish-yellow (10YR 6/6) stratified sand and gravel; single grain (structureless); loose; few roots; strongly acid.

In most wooded areas, a gray layer 2 to 4 inches thick is directly below the surface layer. Tongues of this gray material and the dark reddish-brown B21ir horizon extend into the lower horizon. In cultivated areas, most of the gray layer is mixed with other layers, but traces of the gray material and the reddish-brown B21ir horizon are below the plow layer. The amount and position of gravel in the soil are extremely variable. Gravel may occur anywhere within 18 inches of the surface.

Colton loamy sand, 0 to 3 percent slopes (CoA).—This nearly level soil has a profile similar to the one described for the Colton series. Because it is very droughty, it is a poor agricultural soil. The erosion hazard is slight.

Included in mapped areas of this soil are the small areas of Colton sandy loam.

Colton loamy sand, 0 to 3 percent slopes, is used for cultivated crops, hay, and pasture, but it is expensive to farm because large amounts of fertilizer and irrigation water are needed. Many areas are planted to trees. The erosion hazard is slight. (Capability unit IIIs–26; woodland suitability group 5)

Colton loamy sand, 3 to 8 percent slopes (CoB).—This soil has a profile similar to the one described as typical of the Colton series. Because it is very droughty, it is a poor agricultural soil. The erosion hazard is moderate, but the main problems are the lack of water and the coarse texture.

Included in mapped areas of this soil are small areas of Colton sandy loam.

Colton loamy sand, 3 to 8 percent slopes is used for cultivated crops, hay, and pasture, but it is expensive to farm because large amounts of fertilizer and irrigation water are needed. On long slopes, stripcropping is needed to reduce the loss of soil and water. Many areas of this soil are planted to trees. (Capability unit IIIs–26; woodland suitability group 5)

Colton loamy sand, 8 to 15 percent slopes (CoC).—This soil is similar to Colton loamy sand, 3 to 8 percent slopes, but is much steeper. Its slopes are short, irregular, and difficult to work. Because it is very droughty, it is a poor agricultural soil. The erosion hazard is moderate.

Included in mapped areas of this soil are small areas of Colton sandy loam.

Because it is coarse textured and difficult to work, this soil is used mainly for grass and trees. Sometimes it is cultivated before reseeding to grass. In many places this soil has been planted to trees. (Capability unit IVs–26; woodland suitability group 5)

Colton gravelly loamy sand, 15 to 60 percent slopes (CtE).—This soil is much steeper and contains more gravel than Colton loamy sand, 3 to 8 percent slopes. It occurs in the steepest areas of Colton soils, which are on kames, eskers, and terrace escarpments. The erosion hazard is severe. The steep topography and coarse texture generally make this soil best suited to woodland. (Capability unit VIIs–27; woodland suitability group 5)

Duane Series

In the Duane series are sandy, moderately well drained, extremely acid to strongly acid soils in water-sorted material derived from granite, gneiss, and schist. Their native vegetation consisted of sugar maple, red maple, white birch, beech, spruce, fir, and white pine. These soils occur in slight depressions on outwash plains and on the lower slopes of kames and terraces in the northern part of the county. This part generally receives more moisture and has cooler temperatures and higher elevations than the rest of the county. A seasonally high water table and seeps keep these soils wet in spring, late in fall, and in winter.

The surface layer is very dark gray to very dark grayish-brown sandy loam. Immediately below the surface layer is a gray layer. The upper part of the subsoil is dark reddish-brown sandy loam; the lower part is mottled, yellowish-brown sandy loam. The substratum is mottled, gray gravelly loamy sand.

The Duane soils are near the Colton, Au Gres, and Hermon soils. They differ from the moderately well drained Sudbury soils in having a gray layer below the surface layer and a dark reddish-brown subsoil. The Duane soils are not so well drained as the sandy, water-sorted Colton soils or the sandy Hermon soils, which were derived from glacial till. They are better drained than the sandy Au Gres soils on outwash plains and terraces.

Water movement in Duane soils is hindered by a seasonally high water table; but in dry periods when the water table is lower, water moves rapidly through these soils. These soils must be worked later in spring and require more time to dry out after wet periods than well-drained soils. In most places the Duane soils are free of stones.

Typical profile of Duane fine sandy loam, 0 to 8 percent slopes—

- A0—2 inches to 0, partly decomposed white pine needles and maple leaves.
- A1—0 to 1 inch, very dark gray (10YR 3/1) sandy loam; weak, fine granular structure; friable; many roots; extremely acid; boundary clear, wavy. 1 to 3 inches thick.

A2—1 to 3 inches, gray (10YR 5/1) loamy sand; single grain (structureless); loose; many roots; extremely acid; boundary clear, wavy. 2 to 4 inches thick.

B21ir—3 to 10 inches, dark reddish-brown (5YR 3/3) sandy loam; weak, fine, granular structure; cemented aggregates ¼ to ½ inch across in places; very friable; roots common; strongly acid; boundary clear, wavy. 4 to 8 inches thick.

B22—10 to 15 inches, yellowish-brown (10YR 5/4) sandy loam; gravel 10 percent by volume; weak, fine, granular structure; very friable; roots common; strongly acid; boundary clear, wavy. 3 to 10 inches thick.

B23g—15 to 24 inches, yellowish-brown (10YR 5/4) gravelly loamy sand; gravel 15 percent by volume; common, medium, distinct, yellowish-red (5YR 5/8) mottles; single grain (structureless); loose; few roots; strongly acid; boundary clear, wavy. 8 to 14 inches thick.

Cg—24 to 26 inches +, gray (10YR 5/1) gravelly loamy sand; common, medium, prominent, yellowish-red (5YR 4/8) mottles; single grain (structureless); loose; few roots; underlain by water-sorted sand and gravel.

The surface layer is fine sandy loam in most places, but in a few it is sandy loam. Depth to mottling is variable, but in most places it is 12 to 15 inches below the surface. In amount and position of gravel, this soil is extremely variable. Generally, gravel is within 30 inches or less of the surface. The gray layer that is usually just below the surface layer does not occur in all places. In cultivated areas most of the gray layer is mixed with other layers, but traces of this layer and of the reddish-brown B21ir horizon remain below the plow layer.

Duane fine sandy loam, 0 to 8 percent slopes (DuB).—This soil has a profile similar to the one described for the Duane series. The erosion hazard is moderate on this gently sloping soil. The soil is suitable for cultivated crops, hay, and pasture. Artificial drainage is used to increase the kinds of crops that can be grown and to allow the soil to be worked sooner after rains. On long slopes, diversion ditches and graded strips are used to help prevent the loss of soil and water. (Capability unit IIw-22; woodland suitability group 2)

Gloucester Series

The Gloucester series consists of somewhat excessively drained to well-drained, gently sloping to steep, strongly acid soils that formed in deep, sandy, glacial till derived from granite, gneiss, and schist. Their native forest consisted of mixed hardwoods, mainly beech, birch, maple, and red oak, and of hemlock and white pine. Stones and boulders occur throughout the profile. Gloucester soils are the most common soils in the county. They occur mainly in the central and southern parts.

The surface layer is a very dark brown sandy loam or stony sandy loam; the subsoil is strong-brown or yellowish-brown stony and gravelly loamy sand; and the underlying till is usually light-gray stony and gravelly loamy sand.

The Gloucester soils are better drained than the nearby Acton soils, which are moderately well drained. They contain more sand and stone fragments than the Paxton soils, which have a compact subsoil. In contrast to the Hinckley soils, they do not contain stratified sand and gravel.

Water moves rapidly through these soils and their sandy substratum. Their moisture-holding capacity is low, and crops do not grow so well during dry periods as they do on finer textured soils.

Typical profile of Gloucester very stony sandy loam, 8 to 15 percent slopes—

A00—1 inch to 0, recent accumulation of undecomposed white pine needles and leaves from white oak and gray birch.

A1—0 to 4 inches, very dark brown (10YR 2/2) stony sandy loam; weak, fine, granular structure; very friable when moist; many roots; very strongly acid; boundary clear, wavy. 3 to 4 inches thick.

B21—4 to 9 inches, strong-brown (7.5YR 5/8) stony loamy sand; weak, medium structure that breaks to single grain (structureless); very friable when moist; many roots; strongly acid; boundary clear, wavy. 4 to 5 inches thick.

B22—9 to 18 inches, yellowish-brown (10YR 5/6) stony gravelly loamy sand; weak, medium structure that breaks to single grain (structureless); very friable when moist; many roots; strongly acid; boundary clear, wavy. 8 to 9 inches thick.

B3—18 to 26 inches, light yellowish-brown (2.5Y 6/4) stony gravelly loamy sand; weak, medium structure that breaks to single grain (structureless); very friable when moist; roots common; strongly acid; boundary clear, wavy. 6 to 8 inches thick.

C—26 to 33 inches +, light-gray (2.5Y 7/2) stony gravelly loamy sand; weak, medium, platy structure that breaks to single grain (structureless); friable to firm when moist; somewhat brittle; few roots; medium acid.

The texture of the surface layer ranges from loamy sand to sandy loam. The underlying till generally has weak, fine, granular structure, but in some places it is slightly platy. Consistence of the substratum ranges from loose to slightly firm and brittle.

Gloucester sandy loam, 3 to 8 percent slopes (GcB).—Except that its surface horizon is lighter brown and about 8 inches thick, the profile of this gently sloping soil is similar to the one described for the Gloucester series.

This soil is suitable for row crops, hay, and pasture. Stones have been removed from the surface so that modern farm equipment can be used. The erosion hazard can be minimized by building diversion ditches and terraces, and by planting crops in field strips or contour strips. (Capability unit IIs-55; woodland suitablity group 4)

Gloucester sandy loam, 8 to 15 percent slopes (GcC).—This moderately sloping soil has a dark-brown surface layer about 8 inches thick. Except that its surface horizon is lighter brown, the profile is similar to the one described for the Gloucester series. This soil is suitable for cultivated crops, hay, and pasture. Stones have been removed from the surface so that modern farm equipment can be used. Erosion is a problem, but it can be controlled by field strips, contour strips, and diversion ditches. (Capability unit IIIe-55; woodland suitability group 4)

Gloucester sandy loam, 15 to 25 percent slopes (GcD).—This very strongly sloping soil has a dark-brown surface layer, about 8 inches thick; otherwise, its profile is similar to the one described for the Gloucester series.

This soil is suitable for hay and pasture. Stones have been removed from the surface so that modern farm equipment can be used. The steeper areas are difficult to work safely with farm tractors and are not generally used for row crops. Wherever practical, fields should be reseeded in field strips or contour strips. (Capability unit IVe-55; woodland suitability group 4)

Gloucester very stony sandy loam, 3 to 8 percent slopes (GrB).—Except that it is less sloping, this soil is similar to Gloucester very stony sandy loam, 8 to 15 percent slopes. Stones on the surface are so numerous that the

use of modern farm equipment is not practical. This soil can be used for permanent pasture (fig. 11) and as woodland. (Capability unit VIs–7; woodland suitability group 4)

Gloucester very stony sandy loam, 8 to 15 percent slopes (GrC).—The profile of this soil is similar to the one described for the Gloucester series. Stones on the surface are so numerous that this soil is not suitable for cultivation. It can be used for permanent pasture and as woodland. If stones were removed and the soil cultivated, erosion would be more serious than on less sloping soils. (Capability unit VIs–7; woodland suitability group 4)

Gloucester very stony sandy loam, 15 to 25 percent slopes (GrD).—Except for steeper slopes, this soil is similar to Gloucester very stony sandy loam, 8 to 15 percent slopes. The many stones on the surface make cultivation impractical. This soil is suitable only for permanent pasture and woodland. Equipment is somewhat more difficult to operate on this soil than on less sloping soils. (Capability unit VIs–7; woodland suitability group 4)

Gloucester very stony sandy loam, 25 to 60 percent slopes (GrE.)—Except that it is much steeper, this soil is similar to Gloucester very stony sandy loam, 8 to 15 percent slopes. Stones and boulders are an outstanding characteristic of this soil. Areas where stones have been removed were included in mapping. The extreme steepness and stoniness limit the use of this soil to woodland. (Capability unit VIIs–7; woodland suitability group 4)

Gloucester extremely stony sandy loam, 8 to 25 percent slopes (GsD).—This is the most extensive soil in Merrimack County. It is moderately sloping to moderately steep and occurs on hillsides and mountainsides. The profile of this soil is similar to the profile described for the Gloucester series. Stones and boulders are so numerous that in some places they are only one step apart.

Some areas of less than 8 percent slopes and some that are moderately well drained were included in mapping.

The larger areas of this soil are limited to trees. In some areas boulders are so large and numerous that logging operations can be carried on only in winter when the snow is deep. (Capability unit VIIs–58; woodland suitability group 4)

Gloucester extremely stony sandy loam, 25 to 60 percent slopes (GsE). —Except that it is more steeply sloping and more stony, this soil is similar to Gloucester very stony sandy loam, 8 to 15 percent slopes. Stones and boulders are so numerous and the slopes are so steep that the use of this soil is limited to woodland. Access to many areas of this soil is poor, and roads are often difficult to construct because of steep slopes and boulders. (Capability unit VIIs–58; woodland suitability group 4)

***Figure 11.*—Stones on Gloucester very stony sandy loam restrict the use of this soil to native pasture. If stones are removed, pasture can be limed, fertilized, reseeded, and mowed to increase the yield.**

Gravel Pits (Gv)

Gravel pits are open excavations from which gravel and other material have been removed. Areas mapped as Gravel pits include areas of sand pits and borrow pits. Pits too small to be shown on the soil map are shown by symbol. (Capability unit and woodland suitability group not assigned)

Hermon Series

In the Hermon series are somewhat excessively drained to well-drained, very strongly acid, deep, sandy soils in glacial till. Their native vegetation consisted of spruce, fir, hemlock, white pine, beech, birch, and sugar maple. These gently sloping to steep soils occur on uplands in the northern part of the county. This part generally receives more moisture, has cooler temperatures, and is higher than the rest of the county. Hermon soils developed in soil material derived from granite, gneiss, and schist. Stones and boulders occur throughout the soil.

The surface layer is black or dark-brown sandy loam In most places a gray layer is just below the surface layer. The upper part of the subsoil is reddish-brown stony sandy loam. The lower part is yellowish-brown stony sandy loam. The substratum is light olive-gray stony sandy loam.

The Hermon soils are near or adjacent to Canaan, Gloucester, Paxton, and Colton soils. They are deeper than the shallow Canaan soils. The Hermon soils differ from the Gloucester soils in having a gray layer below the surface layer, and an upper subsoil that is reddish brown instead of yellowish brown. Unlike the well-drained, deep, loamy Paxton soils, they do not have a pan layer. The Hermon soils developed in glacial till, but the Colton soils developed in water-sorted, sandy and gravelly material.

Stones are prominent in the Hermon soils. Even though most stones have been removed, a few have been left on the surface in places. Water moves rapidly through these sandy soils, which are droughty in dry periods and hold little water available to plants.

Typical profile of Hermon very stony sandy loam, 3 to 8 percent slopes—

A0—2 inches to 0, partly decomposed leaves.

A2—0 to 3 inches, gray (10YR 6/1) very stony sandy loam; gravel 5 percent by volume; weak, fine, granular structure; very friable; many roots; very strongly acid; boundary abrupt, wavy. 0 to 4 inches thick.

B21ir—3 to 9 inches, reddish-brown (5YR 5/4) stony sandy loam; gravel about 7 percent by volume; weak, fine, granular structure; very friable; many roots; very strongly acid; boundary clear, wavy. 4 to 7 inches thick.

B22—9 to 26 inches, yellowish-brown (10YR 5/6) stony sandy loam; gravel about 15 percent by volume; weak, fine, granular structure; very friable; roots common; strongly acid; boundary clear, wavy. 12 to 21 inches thick.

C—26 to 30 inches, light olive-gray (5Y 6/2) stony loamy sand; gravel about 30 percent by volume; weak, fine, granular structure; very friable; few roots; strongly acid.

The gray layer below the surface layer does not occur in all areas. In some areas it is mixed with other layers

by cultivation, but remnants of the gray layer and the reddish-brown B21ir horizon remain below the plow layer. The texture of the surface in most places is sandy loam, but in some it is fine sandy loam or loamy sand. The upper part of the subsoil may contain cemented aggregates. Slightly platy structure occurs in the substratum in places.

Hermon sandy loam, 3 to 8 percent slopes (HmB).—This soil has fewer stones on the surface than Hermon very stony sandy loam, 3 to 8 percent slopes; otherwise, the soils are similar. Stones have been removed from the surface so that modern farm equipment can be used.

This gently sloping soil is suitable for hay and pasture. The erosion hazard is moderate. On long slopes stripcropping and diversion ditches are used to reduce the loss of soil and water. (Capability unit IIs-55; woodland suitability group 4)

Hermon sandy loam, 8 to 15 percent slopes (HmC).—This soil is more sloping and has fewer stones on the surface than Hermon very stony sandy loam, 3 to 8 percent slopes; otherwise, the soils are similar. The erosion hazard is more severe for this strongly sloping soil, and control practices must be used. Stones have been removed from the surface so that modern farm equipment can be used.

This soil is suitable for cultivated crops, hay, and pasture. Stripcropping and diversion ditches are needed on long slopes to help prevent the loss of soil and water. (Capability unit IIIe–55; woodland suitability group 4)

Hermon sandy loam, 15 to 25 percent slopes (HmD).—Except that it has fewer stones on the surface and stronger slopes, this soil is similar to Hermon very stony sandy loam, 3 to 8 percent slopes. Stones have been removed from the surface so that modern farm equipment can be used. The steeper areas are difficult to work.

Because of a severe erosion hazard and strong slopes, this soil is best suited to hay and pasture. The less sloping, long fields should be seeded in strips and the strips seeded in different years to reduce the loss of soil and water. (Capability unit IVe–55; woodland suitability group 4)

Hermon very stony sandy loam, 3 to 8 percent slopes (HnB).—This gently sloping soil has a profile similar to the one described for the Hermon series. There are enough stones on the surface to prevent cultivation. This soil is used for permanent pasture or woodland. (Capability unit VIs–7; woodland suitability group 4)

Hermon very stony sandy loam, 8 to 15 percent slopes (HnC).—Except that it is more sloping, this soil is similar to Hermon very stony sandy loam, 3 to 8 percent slopes. Because stones on the surface are so numerous that modern farm equipment cannot be used, this soil is best suited to permanent pasture or woodland. If stones were removed and the soil cultivated, erosion would be more serious than on the less sloping soil. (Capability unit VIs–7; woodland suitability group 4)

Hermon very stony sandy loam, 15 to 25 percent slopes (HnD).—This soil is much steeper than Hermon very stony sandy loam, 3 to 8 percent slopes; otherwise, the soils are similar. Stones on the surface are so numerous that modern farm equipment cannot be used. This soil is suitable for permanent pasture or woodland. (Capability unit VIs–7; woodland suitability group 4)

Hermon extremely stony sandy loam, 8 to 25 percent slopes (HoD).—This soil is more sloping and has more stones on the surface than Hermon very stony sandy loam, 3 to 8 percent slopes. It occurs on hillsides and mountainsides. In many places stones are so numerous that they are only a step apart. Because of these stones, use of this soil is limited to woodland. (Capability unit VIIs–58; woodland suitability group 4)

Hermon extremely stony sandy loam, 25 to 60 percent slopes (HoE).—This is the most stony of the Hermon soils. It occurs on the steepest hillsides and mountainsides in the county. Stones are so numerous that, in many places, they are only a step apart. Use of this soil is limited to woodland because of the number of stones, steepness, and poor access. (Capability unit VIIs–58; woodland suitability group 4)

Hinckley Series

In the Hinckley series are deep, very droughty, excessively drained sandy and gravelly soils that contain very little silt and clay. Their native vegetation consisted of pitch pine, white pine, scrub oak, red oak, and gray birch. They occur on nearly level sandy plains, on gently sloping to moderately sloping kame terraces, on strongly sloping to very steep terrace escarpments, and on eskers. These soils developed in water-sorted sand and gravel derived from granite, gneiss, and schist.

The surface layer of these soils is dark yellowish-brown loamy sand; the subsoil is yellowish-brown gravelly sand; and the substratum is pale-yellow gravelly sand. Hinckley soils are strongly acid.

In contrast to Gloucester soils in stony, sandy glacial till, the Hinckley soils have water-sorted layers of sand and gravel. They are coarser textured than the Merrimac soils. The Hinckley soils are excessively drained in contrast to the moderately well drained Sudbury soils. In many areas they are near the deep, sandy Windsor soils, which have little gravel.

The movement of water is very rapid through these soils, and their moisture-holding capacity is very low. Because they are loose and open, these soils leach rapidly. They are fairly easy to work because they contain no stones, but in places, gravel and small cobbles interfere with tillage. These soils are marginal because they are very droughty and plant nutrients leach rapidly. Many gravel pits are on these soils.

Typical profile of Hinckley loamy sand, 0 to 3 percent slopes—

A00—2 to 1½ inches, recent accumulation of pine needles and twigs.

A0—1½ inches to 0, partly decomposed pine needles and twigs.

Ap—0 to 7 inches, dark yellowish-brown (10YR 5/8) loamy sand; gravel 10 percent by volume; weak, fine, granular structure; very friable; many roots; strongly acid; boundary abrupt, smooth. 6 to 8 inches thick.

B21—7 to 14 inches, yellowish-brown (10YR 5/8) loamy sand; gravel 15 percent by volume; weak, fine, granular structure; very friable; roots common; strongly acid; boundary clear, wavy. 5 to 7 inches thick.

B22—14 to 19 inches, yellowsh-brown (10YR 5/4) gravelly loamy sand; gravel 20 percent by volume; single grain (structureless); loose; roots common; strongly acid; boundary clear, wavy. 3 to 5 inches thick.

D1—19 to 60 inches, pale-yellow (2.5Y 7/4) gravelly sand with strata of fine gravel or sandy gravel; single grain (structureless); loose; few roots; strongly acid; boundary clear, wavy. 40 to 42 inches thick.

D2—60 to 70 inches +, pale-yellow (5Y 7/3) gravelly sand with strata of gravel; single grain (structureless); loose; few roots; strongly acid.

The texture of the surface layer in most places is loamy sand, but sand, gravelly loamy sand, and gravelly sand occur, and in some places cobbles are prominent. The subsoil is generally yellowish brown, but in places it is strong brown.

Hinckley gravelly loamy sand, 15 to 60 percent slopes (HrE).—This soil is much steeper and contains more gravel than Hinckley loamy sand, 0 to 3 percent slopes. It is the steepest soil in the Hinckley series and occurs on kames, eskers, and terrace escarpments. The risk of erosion is high. Steep topography and coarse texture limit the use of this soil to woodland. (Capability unit VIIs-27; woodland suitability group 5)

Hinckley loamy sand, 0 to 3 percent slopes (HsA).—This nearly level soil has a profile similar to the one described for the Hinckley series. Because it is very droughty, it is a poor agricultural soil. The erosion hazard is slight. This soil can be used for cultivated crops, hay, and pasture, but it is expensive to farm because large amounts of fertilizer and irrigation water are needed. Many areas have been planted to trees. (Capability unit IIIs-26; woodland suitability group 5)

Hinckley loamy sand, 3 to 8 percent slopes (HsB).—This soil has a profile similar to the one described for the Hinckley series, but it is more sloping. Because it is very droughty, it is a poor agricultural soil. The erosion hazards are moderate, but the lack of water and coarse texture cause the most problems.

This soil can be used for cultivated crops, hay, and pasture, but it is expensive to farm because large amounts of fertilizer and irrigation water are needed. On long slopes, stripcropping is needed to reduce the loss of soil and water. Many areas have been planted to trees. (Capability unit IIIs-26; woodland suitability group 5)

Hinckley loamy sand, 8 to 15 percent slopes (HsC).—Except that it has much steeper slopes, this soil is similar to Hinckley loamy sand, 0 to 3 percent slopes. Its slopes are short and irregular, and it is difficult to work. Also, it is very droughty and is a poor agricultural soil. The risk of erosion is moderate.

Because this soil has coarse texture and is difficult to work, it is used mainly for grass and trees. Sometimes it is cultivated before it is reseeded to grass. Many areas have been planted to trees. (Capability unit IVs-26; woodland suitability group 5)

Limerick Series

In the Limerick series are nearly level, poorly drained, medium acid soils that developed in water-laid deposits of silt, very fine sand, and clay. Their native vegetation was red maple, elm, hemlock, speckled alder, and white pine. These silty and clayey soils are among the finest textured soils in the county. A high water table keeps them wet most of the time.

The surface layer is very dark brown to gray silt loam; the subsurface layers are gray silt loam mottled with yellowish red.

Limerick soils occur near the moderately well drained Belgrade and Ninigret soils. They are more poorly drained than these soils. They are not so sandy and gravelly as the poorly drained Au Gres soils.

Because of the content of silt and clay in the Limerick soils, water moves slowly through them, even after the high water table is lowered. The underlying layers are saturated most of the time, and plant roots are often damaged.

These soils are difficult to work. They are soft in spring and during other wet periods. In dry periods they are hard and cloddy. They must be worked within a narrow moisture range; otherwise, they are hard to work. Permeability is slow, and water often stands on the surface. Artificial drainage is needed to remove surface water.

Typical profile of Limerick silt loam, high bottom—

Ap—0 to 10 inches, very dark brown (10YR 2/2) silt loam; weak, medium, granular structure; very friable; many roots; medium acid; boundary clear, wavy. 8 to 11 inches thick.

Cg—10 to 36 inches +, grayish-brown (2.5Y 5/2) silt loam; many, medium, prominent, yellowish-red (5YR 4/8) mottles; weak, medium, platy structure; firm in place, friable when disturbed, nonsticky when wet; few roots; thin lenses of silty clay and very fine sand; medium acid; water table at 15 inches early in November.

The texture of the surface layer is silt loam in most places, but in a few it is very fine sandy loam. The color of the surface layer ranges from very dark brown to gray. Mottling generally begins within 10 inches of the surface.

Limerick silt loam, high bottom (Lm).—This nearly nearly level soil has a profile similar to the one described for the Limerick series. The erosion hazard is slight. Small areas are wetter than normal for Limerick soils. In Merrimack County, Limerick silt loam, high bottom, is high enough that flooding is not a problem.

Because it is poorly drained, this soil is best suited to hay and midsummer pasture. If the soil is drained, grass-legume crops of better quality and an occasional cultivated crop can be grown. In a few places this soil is gently sloping. (Capability unit IIIw-13; woodland suitability group 7)

Made Land (Ma)

Made land consists of areas that have been filled with various kinds of soil material. These disturbed areas have not developed under natural conditions. They consist of athletic fields, parking lots, and areas near construction. One area occurs near the Franklin Falls Dam, where waste soil material was dumped and leveled. Made land has no agricultural value, although some areas may be suitable for trees. (Capability unit and woodland suitability group not assigned)

Marsh (Mh)

Marsh consists of areas covered by shallow water most of the time. It occurs mainly around the edge of lakes and ponds but is also in depressions that contain water during much of the year. Its vegetation consists of grasses, reeds, sedges, cattails, and rushes. It is too wet for trees. Marsh has no value for cultivation, grazing, or forestry but is a very important habitat for wildlife, especially waterfowl. (Capability unit VIIIw-89; woodland suitability group not assigned)

Merrimac Series

The Merrimac series consists of droughty, sandy, strongly acid soils underlain by gravel. These soils occur on nearly level sandy plains and gently sloping to moderately sloping kame terraces. Their native vegeta-

tion consisted of white pine, gray birch, red maple, and red oak. These soils developed in water-sorted material derived from granite, gneiss, and schist. They are not subject to flooding, as they are high above the stream level.

The surface soil is very dark grayish-brown sandy loam; the subsoil is yellowish-brown sandy loam and gravelly loamy sand; the substratum is yellowish-brown to pale-brown stratified gravelly loamy sand and stratified sand.

Merrimac soils are better drained than the moderately well drained Sudbury soils. They are finer textured than the gravelly and sandy Hinckley soils. They are water sorted in contrast to the Gloucester soils in stony glacial till. Merrimac soils have a yellowish-brown subsoil, whereas the Colton soils have a reddish-brown subsoil and, in many places, a gray layer below the surface layer. Merrimac soils are commonly near the sandy Windsor soils, which have little gravel.

Water moves rapidly through the subsoil and substrata of the Merrimac soils. Because they are sandy and gravelly soils, they are droughty and have a low moisture-holding capacity. Crops are damaged by lack of moisture during fairly short, dry periods. The soils are fairly easy to work, as they have no stones.

Typical profile of Merrimac sandy loam, 0 to 3 percent slopes—

Ap—0 to 11 inches, very dark grayish-brown (10YR 3/2) sandy loam; gravel 1 percent by volume and ¼ inch to 3 inches in diameter; weak, fine, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 10 to 12 inches thick.

B21—11 to 16 inches, yellowish-brown (10YR 5/6) sandy loam; gravel 5 percent by volume and ¼ inch to 3 inches in diameter; weak, fine, granular structure; very friable; roots common; strongly acid; boundary clear, wavy. 4 to 6 inches thick.

B22—16 to 25 inches, yellowish-brown (10YR 5/4) gravelly loamy sand; gravel 30 percent by volume and ¼ inch to 3 inches in diameter; single grain (structureless); loose; roots common; strongly acid; boundary clear, wavy. 8 to 10 inches thick.

D—25 to 34 inches +, light yellowish-brown (10YR 6/4) stratified sand and gravelly sand; in places contains 50 percent or more gravel, mostly ¼ inch to 3 inches in diameter; single grain (structureless); loose; few roots; strongly acid.

The texture of the surface layer is generally sandy loam, but in places it is fine sandy loam, gravelly sandy loam, or gravelly fine sandy loam. Depth to gravel ranges from about 18 to 30 inches. The subsoil is generally yellowish brown, but it is strong brown in some places.

Merrimac sandy loam, 0 to 3 percent slopes (MmA).—This soil has a profile similar to the one described for the Merrimac series. The erosion hazard is slight. This soil is suitable for cultivated crops, hay, and pasture. Irrigation is needed for satisfactory yields. (Capability unit IIs–25; woodland suitability group 5)

Merrimac sandy loam, 3 to 8 percent slopes (MmB).—This soil is similar to Merrimac sandy loam, 0 to 3 percent slopes, but it is gently sloping and the erosion hazard is greater.

This soil is suitable for cultivated crops, hay, and pasture. On long slopes, it should be worked in field strips or contour strips. Terraces are needed if row crops are grown continuously. Irrigation is needed for satisfactory yields. (Capability unit IIs–25; woodland suitability group 5)

Merrimac sandy loam, 8 to 15 percent slopes (MmC).—This soil is similar to Merrimac sandy loam, 0 to 3 percent slopes, but it has complex slopes on small mounds or hills and is cut by many drains. For this reason, application of irrigation water is more difficult than on smoother and more gentle slopes. The erosion hazard is moderate and is greatest in spring when the soil is thawing.

This soil is suitable for hay, pasture, and cultivated crops. Because it has short, irregular slopes, it is difficult to work. It is best suited to hay. Long hayfields are reseeded in field strips to help reduce the loss of soil and water. (Capability unit IIIe–25; woodland suitability group 5)

Mixed Alluvial Land (Mn)

Mixed Alluvial Land consists of recent stream alluvium. The native vegetation was alder, red maple, elm, and willow trees, and cattails and sedges. This miscellaneous land type is extremely variable in texture and drainage. It occurs on nearly level flood plains along streams and is flooded yearly. It receives deposits of silt, sand, and gravel with each flood. Generally, it is very poorly drained, but mounds of better drained material occur in places. A high water table and frequent flooding keep this land waterlogged most of the time.

This land type is generally used as a wildlife habitat, but in some places the better drained areas are used as permanent pasture. In most places artificial drainage is not feasible. (Capability unit VIIw–14; woodland suitability group not assigned)

Muck and Peat (Mp)

Muck and Peat is a land type that consists of deposits of organic matter that are more than 12 inches deep. The native vegetation on areas not forested consisted of mosses, sedges, and reeds, and high bush blueberry and cranberry bushes. Forested areas produced red maple, gray birch, white pine, black spruce, hemlock, and tamarack. This land type is in formerly ponded depressions where plant remains have accumulated over a long time. The groundwater level is near enough to the surface to saturate the plant remains most of the year and thus help preserve them. In some places the surface layer formed from trees and other woody plants. In other places it formed from mosses, reeds, and sedges. If plant remains are readily identified, the material is peat. If the plant parts have decomposed and are not readily identified, the material is muck. Most areas are extremely acid.

These very wet, level areas of Muck and Peat occupy depressions in uplands, in sandy plains, and in flood plains. They are frequently flooded by runoff from adjacent higher soils. These depressions are frost pockets; the cold air that moves into them from higher areas causes frost very late in spring and early in fall. The depth of Muck and Peat varies widely. Its depth ranges from 12 to 50 feet, but in most places it is 3 feet deep or more.

Before farm tractors were in general use, many areas of Muck and Peat were mowed for hay. Because they were very wet, some areas were cut with a hand scythe. If mowed with horses, special shoes were used to keep the horses from sinking into the soft organic matter. Today, however, areas of Muck and Peat are seldom used for

agricultural purposes in Merrimack County, although a very small area is in permanent hay and pasture. Areas of Muck and Peat are rarely drained artificially because of the high cost and lack of suitable outlets. The danger of frost late in spring and early in fall and of flooding also limit their agricultural use. Farm ponds are sometimes dug in areas of Muck and Peat. The water, however, is stained brown by organic matter and is not desirable for swimming. These organic soils are used mainly for wildlife. (Capability unit VIIw-14; woodland suitability group 9)

Ninigret Series

In the Ninigret series are moderately well drained very fine sandy soils with little coarse sand or gravel. Their native vegetation consisted of white pine, red maple, red oak, and gray birch. These soils occupy shallow depressions in nearly level stream terraces and in old glacial lakebeds. They developed in water-sorted very fine sand derived from granite, schist, and gneiss. Most areas of these soils are in the valleys of the Merrimack and Contoocook Rivers.

The surface layer is dark-brown very fine sandy loam; the subsoil is yellowish-brown fine sandy loam mottled with strong brown; the substratum is light-gray loamy fine sand mottled with yellowish brown. The Ninigret soils are strongly acid.

The Ninigret soils occur close to the well-drained Agawam soils. They are finer textured than the moderately well drained Sudbury soils, which have gravelly layers. In contrast to the moderately well drained Ninigret soils, the Au Gres are poorly drained sandy soils, and the Windsor are excessively drained, very droughty sandy soils.

A seasonally high water table is close to the surface during wet periods and restricts the downward movement of water. Water drains rapidly through these soils when the water table is lowered. During wet periods, the excess water on these soils limits the use of farm machinery. During dry periods the soils generally supply adequate moisture for plants. These soils are easy to work, as they have no stones or gravel. They must be worked later in spring than soils that have better natural drainage. These soils can be drained well with tile.

Typical profile of Ninigret very fine sandy loam, 0 to 3 percent slopes—

Ap—0 to 10 inches, dark-brown (10YR 3/3) very fine sandy loam; weak, fine, granular structure; very friable; many roots; strongly acid; boundary abrupt, wavy. 12 to 14 inches thick.

B21—10 to 18 inches, yellowish-brown (10YR 5/6) fine sandy loam; weak, medium, granular structure; very friable; roots common; strongly acid; boundary clear, wavy. 2 to 7 inches thick.

B22g—18 to 31 inches, light yellowish-brown (2.5Y 6/4) fine sandy loam; few, fine, distinct, strong-brown (7.5YR 5/8) mottles; weak, medium, granular structure; very friable; few roots; strongly acid; boundary clear, wavy. 8 to 14 inches thick.

B3g—31 to 37 inches, light yellowish-brown (2.5Y 6/4) loamy fine sand; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, medium, granular structure; very friable; few roots; strongly acid; boundary clear, wavy. 3 to 7 inches thick.

C1g—37 to 46 inches, light-gray (2.5Y 7/2) loamy fine sand; many, medium, prominent, yellowish-brown (10YR 5/8) mottles; weak, medium, granular structure; very friable; few roots; strongly acid; boundary clear, wavy. 9 to 12 inches thick.

C2g—46 to 60 inches +, light-gray (2.5Y 7/2) loamy fine sand; many, medium, prominent, yellowish-brown (10YR 5/8) mottles; single grain (structureless); loose; few roots; strongly acid.

The range in texture of the surface layer is very narrow. In most places the texture is very fine sandy loam, but in a few it is fine sandy loam. Depth to mottling ranges from 12 to 24 inches. In a few places the substratum contains lenses of silt and clay.

Ninigret very fine sandy loam, 0 to 3 percent slopes (NnA).—This soil has a profile similar to the one described for the Ninigret series. Some small sloping areas were included in mapping. This nearly level soil is subject to slight erosion. It is suitable for cultivated crops, hay, and pasture, but if it is artificially drained, truck crops and other row crops grow better. (Capability unit IIw-22; woodland suitability group 2)

Ondawa Series

The Ondawa series consists of nearly level, well-drained, moderately coarse textured soils on flood plains. Their native vegetation was elm, sugar maple, red maple, willow, and hophornbeam. These soils are in recent alluvium derived from acidic granite, gneiss, and schist. They are most common in the valleys of the Merrimack and Contoocook Rivers, but they occur near other streams that have flood plains.

These medium acid soils have a very dark grayish-brown fine sandy loam surface layer and a dark grayish-brown fine sandy loam subsoil.

The Ondawa soils are finer textured than the sandy Suncook soils, which are also on flood plains. They are closer to the level of the stream and more grayish brown than the Agawam soils on terraces. They are finer textured than the sandy and gravelly Hinckley soils.

Most areas of Ondawa soils are cleared. Although these soils are well drained, streams affect the water table, and trees that are usually on wetter soils grow well. Water moves through these soils rapidly, but enough moisture is held available for crops during the normal growing season. The subsoil is friable to very friable and has no impermeable layers. Ondawa soils are easy to work because they have no stones, cobbles, or gravel to interfere with tillage.

Typical profile of Ondawa fine sandy loam—

Ap—0 to 12 inches, very dark grayish-brown (2.5Y 3/2) fine sandy loam; weak, fine, granular structure; very friable; many roots; slightly acid; boundary clear, smooth. 10 to 12 inches thick.

C1—12 to 15 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; many roots; medium acid; boundary clear, smooth. 2 to 3 inches thick.

C2—15 to 48 inches +, dark grayish-brown (10YR 4/2) fine sandy loam; weak, medium, granular structure; very friable; roots common; medium acid.

The texture of the surface layer is fine sandy loam in most places, but in a few small areas it is sandy loam or very fine sandy loam. Mottles may occur below a depth of 36 inches. Coarse sand and gravel may occur below 24 inches in the Ondawa soils that are along the smaller streams. Along the Merrimack and Contoocook Rivers and other large streams, coarse sand and gravel seldom occur within 10 feet of the surface.

Ondawa fine sandy loam (Of).—This soil has a profile similar to the one described for the Ondawa series. Flooding is a hazard, as this soil is on low bottoms.

This soil is suited to cultivated crops, hay, and pasture (fig. 12). Truck crops are well suited. A common cropping system consists of a continuous row crop followed by a winter cover crop, but if wind erosion is a problem, hay or pasture is grown for 2 years or more. (Capability unit IIw-10; woodland suitability group 2)

Ondawa fine sandy loam, high bottom (Oh).—Under the plow layer this soil is yellowish brown. Otherwise, this nearly level soil is similar to Ondawa fine sandy loam. It is higher than the soils on low bottoms, and the hazard of flooding is much less. It is seldom flooded.

This soil is suited to cultivated crops, hay, and pasture. Truck crops are especially well suited. Continuous row crops are commonly grown, each followed by a winter cover crop. A common rotation is 2 years of row crops followed by a winter cover crop and then by 2 years or more of hay or pasture. (Capability unit I-1; woodland suitability group 2)

Figure 12.—**Ondawa fine sandy loam on nearly level, well-drained flood plain. Some of the largest farms in the county are on the flood plain of the Merrimack River.**

Figure 13.—**Young apple trees on Paxton loam.**

Paxton Series

In the Paxton series are well-drained, medium to moderately coarse textured, strongly acid soils in glacial till that have a pan layer. Their native vegetation was red oak, white oak, sugar maple, red maple, beech, birch, white pine, and hemlock. They occur on the sharper crests of drumlins and on moderately sloping and steep hillsides. These soils formed in material derived from mica schist, gneiss, and granite. Stones and boulders occur less frequently throughout the profile than in other soils in glacial till. The pan layer occurs 18 to 24 inches below the surface.

The surface layer is very dark grayish-brown loam; the subsoil is strong-brown and light olive-brown fine sandy loam; the substratum is olive fine sandy loam.

The Paxton soils are near or adjacent to the Shapleigh, Woodbridge, and Gloucester soils, which also developed in glacial till. Unlike the Shapleigh soils, they are not shallow to bedrock. They are better drained than the moderately well drained Woodbridge soils. The Paxton soils are not so coarse textured and sandy as the Gloucester soils.

Movement of water is moderate through the soil above the pan layer but is slow through the pan. When the pan is moist, it is slightly less firm in the first few inches but remains very firm in the lower part. Water moves downslope above the pan layer and comes to the surface as seeps. The pan holds moisture available to plants, which on these soils are among the last to show a need for water. The soils must be worked later in spring than other well-drained soils on uplands because the pan slows the downward movement of water. The water table seldom rises above the pan layer.

Bedrock commonly crops out near Paxton soils. Most stones have been removed from the surface, but a few have been left in places. The Paxton soils are among the better agricultural soils on uplands in Merrimack County. Many apple orchards (fig. 13) and dairy farms are on these soils.

Typical profile of Paxton very stony loam, 8 to 15 percent slopes—

A0—1 inch to 0, recent accumulation of white pine needles and maple leaves.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 3 to 4 inches thick.

B21—3 to 8 inches, strong-brown (7.5YR 5/6) loam; weak, medium, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 4 to 6 inches thick.

B22—8 to 16 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, medium, granular structure; very friable; roots common; strongly acid; boundary clear, wavy. 5 to 8 inches thick.

B23—16 to 22 inches, light olive-brown (2.5Y 5/4) fine sandy loam with lenses of sand in the lower part; weak, thin, platy structure; friable; few roots; strongly acid; boundary clear, wavy. 4 to 6 inches thick.

B24m—22 to 30 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, medium, platy structure; firm; few roots; strongly acid; boundary clear, wavy. 7 to 9 inches thick.

B25m—30 to 60 inches, olive (5Y 4/2) fine sandy loam; moderate, coarse, prismatic and moderate, medium, platy structure; prisms are outlined with ½- to 1-inch, gray (5Y 5/1) bands that have a ⅛ to ¼-inch, reddish-brown border; very firm when moist, hard when dry; strongly acid.

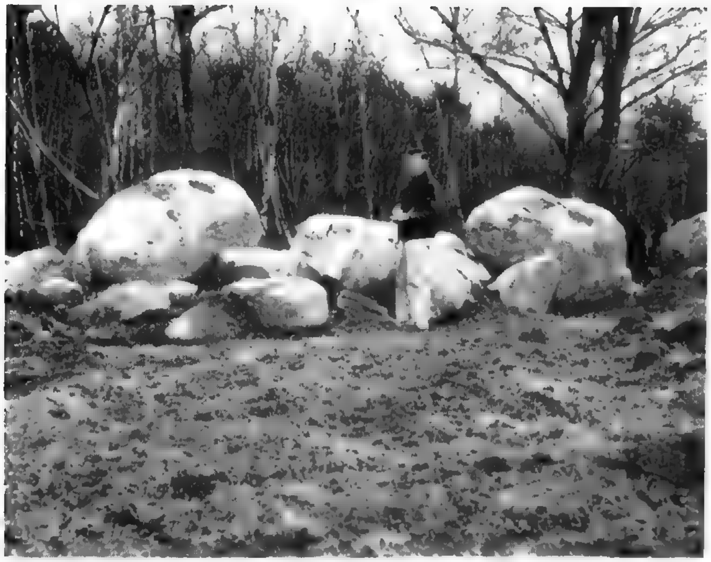

Figure 14.—**Large stones deposited by glaciers have been removed from the field to permit the use of farm equipment.**

The texture of the surface layer is loam or fine sandy loam. Faint mottles may occur in the layer above the pan.

Paxton loam, 0 to 8 percent slopes (PaB).—This soil is less sloping and has fewer stones on the surface than Paxton very stony loam, 8 to 15 percent slopes; otherwise, the soils are similar. The hazard of erosion is moderate. Stones have been removed from the surface so that modern farm equipment can be used (fig. 14).

This soil is suitable for cultivated crops, hay, and pasture. On long slopes, stripcropping and diversion ditches are needed to reduce the loss of soil and water. (Capability unit IIe-6; woodland suitability group 2)

Paxton loam, 8 to 15 percent slopes (PaC).—This soil has fewer stones on the surface than Paxton very stony loam, 8 to 15 percent slopes; otherwise, the soils are similar. The hazard of erosion is greater than that on the less sloping soil. Stones have been removed from the surface so that modern farm equipment can be used.

This soil is suitable for cultivated crops, hay, and pasture. Stripcropping and diversion ditches are needed on long slopes to reduce the loss of soil and water. If diversion ditches, field strips, or other practices to control erosion are not used on long slopes, this soil is best used for grass. (Capability unit IIIe-6; woodland suitability group 2)

Paxton loam, 15 to 25 percent slopes (PaD).—This soil is more sloping and has fewer stones on the surface than Paxton very stony loam, 8 to 15 percent slopes; otherwise, the soils are similar. The hazard of erosion is severe. The steeper areas are difficult to work with a tractor. Stones have been removed from the surface. Because of very strong slopes, this soil is generally best suited to hay and pasture. (Capability unit IVe-6; woodland suitability group 2)

Paxton very stony loam, 3 to 8 percent slopes (PnB).—This gently sloping soil has a profile similar to the one described for the Paxton series. Stones are so numerous on the surface that cultivated crops are not grown. Because it is stony, this soil is generally used for permanent pasture and woodland. (Capability unit VIs-7; woodland suitability group 2)

Paxton very stony loam, 8 to 15 percent slopes (PnC).—This soil has a profile similar to the one described for the Paxton series. It is moderately sloping and has stones on the surface that prevent use of modern farm equipment. Because of the large number of stones, this soil is more often used for permanent pasture and woodland. If stones are removed and the soil is cultivated, erosion is more serious than on the less sloping soils. (Capability unit VIs-7; woodland suitability group 2)

Paxton very stony loam, 15 to 25 percent slopes (PnD).—This soil is more sloping than Paxton very stony loam, 8 to 15 percent slopes. Stones are so numerous on its surface that cultivated crops are not grown. Because of the large number of stones and the very strong slopes, this soil is best suited to permanent pasture and woodland. (Capability unit VIs-7; woodland suitability group 2)

Paxton very stony loam, 25 to 60 percent slopes (PnE).—This is the steepest soil in the Paxton series. The many stones on the surface and the steepness of the slopes limit the use of this soil to woodland, wildlife, and recreation. (Capability unit VIIs-7; woodland suitability group 2)

Podunk Series

The Podunk series consists of moderately well drained, strongly acid to medium acid soils. Their native vegetation was elm, red maple, willow, and alder. These soils occupy slight depressions, narrow strips next to terrace escarpments, and broad areas on the nearly level flood plains throughout the county. The lower lying areas are subject to flooding. These soils formed in water-deposited sediments derived from acidic granite, schist, and gneiss.

The very dark grayish-brown fine sandy loam surface layer of these soils is underlain by a brown fine sandy loam subsoil that is mottled with yellowish brown and strong brown.

The Podunk soils occur near the well-drained Ondawa and poorly drained Rumney soils on flood plains. They are finer textured and hold more moisture than the gravelly Hinckley and the sandy Windsor soils on nearby stream terraces.

These soils hold moisture available for crops during dry periods because they are kept moist by a fairly high water table and by seepage from adjacent terrace escarpments. The water table is closer to the surface in wet seasons. Water moves through these soils rapidly after the water table is lowered. The soils have no stones, cobbles, or gravel to interfere with tillage.

Typical profile of Podunk fine sandy loam—

Ap—0 to 12 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, fine, granular structure; friable; many roots; strongly acid; boundary abrupt, smooth. 10 to 12 inches thick.

C1g—12 to 28 inches, brown (10YR 5/3) fine sandy loam; few, fine, faint, yellowish-brown (10YR 5/8) mottles; weak, fine, granular structure; very friable; roots common; medium acid; boundary clear, smooth. 14 to 16 inches thick.

C2g—28 to 40 inches, brown (10YR 5/3) fine sandy loam; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, fine, granular structure; friable; few roots; medium acid.

The texture of the surface layer in most places is fine sandy loam, but in a few it is sandy loam and very fine sandy loam. Depth to mottling ranges from 15 to 30 inches..

Podunk fine sandy loam (Po).—This soil has a profile similar to the one described for the Podunk series. It is suitable for cultivated crops, hay, and pasture. Streambank erosion is a problem; and in some places in farmed fields, it creates odd, irregular areas that are hard to manage. Low lying areas of this soil are occasionally flooded, but crops are not seriously damaged. (Capability unit IIw–12; woodland suitability group 2)

Ridgebury Series

In the Ridgebury series are poorly drained soils in glacial till that have a pan layer. Their native vegetation consisted of red maple, elm, speckled alder, white pine, and high bush blueberry. These soils formed in material derived from schist, granite, and gneiss. Stones and boulders occur throughout the profile. The Ridgebury soils occur on level to gently sloping, smooth crests of hills, in depressions, and on the lower slope of hillsides. The pan layer occurs at a depth of 12 to 24 inches. It is hard when dry, and firm and brittle when wet.

The surface layer is very dark brown to very dark gray loam; just below the surface layer in most places is a mottled gray layer; the subsoil and substratum, including the pan layer, are mottled, light olive-brown sandy loam or loam. Ridgebury soils are strongly acid.

The Ridgebury soils are near the Gloucester, Paxton, and other well-drained soils on uplands. They occur close to the Woodbridge and Acton soils, which have better natural drainage. They also occur with the Whitman soils, which are very poorly drained.

Ridgebury soils are saturated most of the time by a high water table that is near the surface late in fall, in winter, and most of the spring. After the water table lowers, the movement of water is moderate above the pan layer and slow through it. The saturated soil severely restricts plant growth. As the soils are waterlogged for long periods, aeration is limited. These soils are slow to warm in spring. Although most stones have been removed, a few have been left on the surface in places.

Typical profile of Ridgebury loam, 3 to 8 percent slopes—

Ap—0 to 8 inches, very dark brown (10YR 2/2) loam; few, fine, distinct, yellowish-red (5YR 5/8) mottles; weak, fine, granular structure; friable; many roots; strongly acid; boundary clear, wavy. 6 to 8 inches thick.

A2g—8 to 13 inches, gray (10YR 6/1) sandy loam; common, fine, distinct, yellowish-red (5YR 5/8) mottles; weak, fine, granular structure; very friable; roots common; strongly acid; boundary clear, wavy. 5 to 8 inches thick.

B21g—13 to 18 inches, light olive-brown (2.5Y 5/4) sandy loam; gravel 5 percent by volume; common, fine, distinct, yellowish-red (5YR 5/8) mottles; weak, coarse, granular structure; friable; few roots; boundary clear, wavy. 3 to 5 inches thick.

B22gm—18 to 30 inches +, light olive-brown (2.5Y 5/4) loam; gravel 5 percent by volume; many, medium, distinct, yellowish-red (5YR 5/8) mottles; weak, medium, platy structure; firm in place, friable when disturbed; few roots; strongly acid.

The texture of the surface layer is loam in most places, but is fine sandy loam and sandy loam in some. Depth to mottling ranges from near the surface to 8 inches below it. The pan layer occurs within 24 inches of the surface, but in most places it is between 12 and 24.

Ridgebury loam, 0 to 3 percent slopes (RbA).—Except that it is less sloping, this soil is similar to Ridgebury loam, 3 to 8 percent slopes. It is nearly level and is susceptible to slight erosion. Stones have been removed from the surface so that modern farm equipment can be used. Because of poor natural drainage, this soil is best suited to hay and pasture. After the high water table has been lowered by artificial drainage, the soil is sometimes used for cultivated crops. (Capability unit IIIw–63; woodland suitability group 3)

Ridgebury loam, 3 to 8 percent slopes (RbB).—This soil has a profile similar to the one described for the Ridgebury series. It is gently sloping and is susceptible to slight erosion. Stones have been removed from the surface so that modern farm equipment can be used. Because of the poor natural drainage, this soil is best suited to hay or pasture. After the water table has been lowered by artificial drainage, the soil is sometimes used for cultivated crops. Outlets for artificial drains are more easily located on this soil than on Ridgebury loam, 0 to 3 percent slopes. (Capability unit IIIw–63; woodland suitability group 3)

Ridgebury and Whitman very stony loams, 0 to 3 percent slopes (RdA).—This undifferentiated unit consists of very stony, poorly drained Ridgebury soils and very stony, very poorly drained Whitman soils. Because these soils have similar characteristics and have limited agricultural use, they were not mapped separately in the county. All areas mapped, however, do not contain both soils. A profile of a Whitman soil is described under the Whitman series.

In a few places, small areas of Whitman loam are included in this undifferentiated group.

Ridgebury and Whitman very stony loams, 0 to 3 percent slopes, are nearly level to gently sloping, strongly acid soils in depressions and in broad, level areas. Stones and boulders occur throughout the profile. The soils are saturated by a high water table that is close to the surface in spring, late in fall, and in winter. The very poorly drained Whitman soils in this unit are commonly ponded.

Because they are poorly drained and have enough stones on the surface to prevent the use of modern farm equipment, these soils are used for permanent pasture and as woodland. (Capability unit VIIs–74; woodland suitability group 3)

Ridgebury and Whitman very stony loams, 3 to 8 percent slopes (RdB).—These gently sloping to sloping soils are in depressions and at the base of long slopes. Water is seldom ponded on these soils. Ridgebury soils are dominant. Because they are poorly drained and have many stones on their surface, these soils are used for permanent pasture and woodland. (Capability unit VIIs–74; woodland suitability group 3)

Riverwash (Rh)

Riverwash consists of sand, gravel, and cobbles on flood plains adjacent to streams. This coarse material is deposited by floodwater or is exposed when the stream changes its channel. Riverwash occurs as sandbars in many places. It is subject to frequent shifting by swift currents. These areas are bare in most places and have

no agricultural value. If undisturbed for a long period, some areas may be suitable for planting trees. (Capability unit VIIIs-90; woodland suitability group not assigned)

Rock Outcrop (Ro)

Rock outcrop consists of areas of nearly bare bedrock. It is on mountaintops, hilltops, and the sides of steep cliffs. Vegetation is very sparse and consists mostly of moss, lichens, and small, scrubby trees. The top of Mt. Kearsarge is an example of Rock outcrop. Some of these nonagricultural areas have value for recreation and scenery. (Capability unit VIIIs-90; woodland suitability group not assigned)

Rumney Series

The Rumney series consists of poorly drained, medium acid to strongly acid soils in depressions on nearly level flood plains. Their native vegetation was red maple, elm, willow, and alder. These soils consist of recently deposited material derived from granite, schist, and gneiss. They are nearly the same level as the stream and are frequently flooded by backwater. A high water table and seepage from terrace escarpments keep these soils saturated for long periods and limit their use.

The very dark brown fine sandy loam surface layer is underlain by a light brownish-gray and gray fine sandy loam subsoil. The Rumney soils are more poorly drained than the moderately well drained Podunk soils, the well drained Ondawa soils, and the excessively drained, sandy Suncook soils, which are on flood plains. They are finer textured and more poorly drained than the gravelly Hinckley and sandy Windsor soils on adjacent stream terraces.

Movement of water through these soils is restricted by the high water table. During periods when the water table is lower, water moves rapidly through these soils. Aeration is poor because the soils are waterlogged. These soils have no stones, cobbles or gravel to interfere with cultivation.

Typical profile of Rumney fine sandy loam—

Ap—0 to 10 inches, very dark brown (10YR 2/2) fine sandy loam with many reddish-brown root stains; weak, fine, granular structure; friable; many roots; strongly acid; boundary abrupt, wavy. 8 to 10 inches thick.

C1g—10 to 15 inches, light brownish-gray (10YR 6/2) fine sandy loam; few, fine, distinct, strong-brown (7.5YR 5/8) mottles; weak, fine, granular structure; friable; roots common; medium acid; boundary clear, wavy. 5 to 6 inches thick.

C2g—15 to 30 inches +, gray (10YR 6/1) fine sandy loam; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, fine, granular structure; friable; few roots; medium acid.

In most places the texture of the surface layer is fine sandy loam, but in some it is very fine sandy loam, sandy loam, and loamy sand. In some places the color of the surface layer is dark grayish brown. Mottling varies; it may begin at the surface or within a depth of 10 inches.

Rumney fine sandy loam (Ru).—This soil has a profile similar to the one described for the Rumney series. Because of prolonged waterlogging and occasional flooding, this soil is best suited to hay. Artificial drainage is difficult because the soil is about the same level as the stream. If it is drained, the soil can be used for pasture in summer and for row crops. (Capability unit IIIw-13; woodland suitability group 7)

Saco Series

The Saco series consist of very poorly drained, strongly acid soils in recent alluvium on flood plains. Their native vegetation consisted of alders, red maple, elm, cattails, sedges, and rushes. These soils occupy level areas, depressions, old oxbows, and sloughs on bottom lands throughout the county. They are in fine-textured deposits derived from granite, schist, and gneiss.

The very dark gray silt loam surface layer is underlain by a gray silty or clayey subsoil.

The Saco soils are very poorly drained in contrast to the well drained Ondawa, the moderately well drained Podunk, and the poorly drained Rumney soils, which are on flood plains. Generally, the Saco soils are next to terrace escarpments of the gravelly Hinckley and the sandy Windsor soils.

The Saco soils are flooded yearly, and their subsoil is saturated most of the time by a high water table and by seepage from the terrace escarpments. Water drains through these soils slowly, and aeration is poor. Because they are wet and soft, these soils cannot be worked with a farm tractor.

Typical profile of Saco silt loam—

Ap—0 to 7 inches, very dark gray (10YR 3/1) silt loam with many root stains; weak, medium, granular structure; friable; many roots; strongly acid; boundary abrupt, smooth. 7 to 8 inches thick.

Cg—7 to 15 inches, gray (10YR 6/1) silt loam; common, medium, prominent, yellowish-red (5YR 4/6) mottles; massive (structureless); firm; few roots; strongly acid.

The texture of the surface layer and subsoil ranges from silt loam to sandy loam. In places the surface layer contains a large amount of organic matter. In places the surface layer is soft and spongy.

Saco silt loam (Sa).—This soil has a profile similar to the one described for the Saco series. Fresh deposits of sediment are added each year by floodwater.

Some soils that have a silty clay loam subsoil were included in mapping.

Brush and trees cover most areas of this soil, but the better drained parts are suitable for pasture during dry periods. It is seldom feasible to drain this soil because it is almost as low as the stream. Areas that are not improved have some value for wetland wildlife. (Capability unit VIIw-14; woodland suitability group 9)

Scarboro Series

In the Scarboro series are very poorly drained, sandy soils in depressions on nearly level sandy plains and terraces. Their native vegetation consisted of red maple, elm, white pine, alder, and high bush blueberry. These soils developed in water-sorted sandy material derived from granite, gneiss, and schist. They are saturated most of the year by a very high water table, and in places water is on the surface.

The surface layer is very dark gray to black fine sandy loam; the underlying layers are gray loamy sand that grades to sand and gravel with increasing depth. The Scarboro soils are strongly acid.

The Scarboro soils are near the Hinckley, Merrimac, Au Gres, and Windsor soils. They are very poorly drained sandy soils. In contrast, the Hinckley are excessively drained sandy and gravelly soils; the Merrimac are well drained; the Au Gres are poorly drained sandy soils; and the Windsor are excessively drained sandy soils with little or no gravel.

A very high water table restricts the downward movement of water. When the water table is lowered, however, water moves rapidly through these sandy open soils. These soils are waterlogged most of the time and in most places cannot be worked with farm equipment.

Typical profile of Scarboro fine sandy loam—

A0—3 inches to 0, partly decomposed alder leaves and grass.

Apg—0 to 9 inches, very dark gray (10YR 3/1) fine sandy loam; common, fine, distinct, yellowish-brown (10 YR 5/8) mottles; weak, medium, granular structure; very friable; many roots; strongly acid; boundary clear, smooth. 7 to 9 inches thick.

Bg—9 to 16 inches, gray (5Y 5/1) loamy sand; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, granular structure; friable; few roots; water table at 15 inches; strongly acid; boundary clear, wavy. 5 to 7 inches thick.

Cg—16 to 25 inches, gray (N 5/0) loamy sand, with thin strata of medium and coarse sand; many, coarse, prominent, strong-brown (7.5YR 5/6) mottles; weak, medium, granular structure; firm; strongly acid.

The texture of the surface layer in most places is fine sandy loam, but in some places it is very fine sandy loam, sandy loam, or loamy sand. The Scarboro soils that are near the Hinckley and Merrimac soils generally contain gravel. The surface layer is very dark gray or black in places because of a large amount of organic matter. In some places the organic surface layer is as much as 12 inches thick. Mottling may be absent in places because of extreme gleying throughout the profile.

Scarboro fine sandy loam (Sc).—This soil has a profile similar to the one described for the Scarboro series. Because this nearly level soil is very poorly drained, it is best suited to permanent pasture or woodland. In most places drainage is not practical, as good outlets are not available. Even where drainage is practical, wetness is still a problem, and the most intensive feasible use of the drained soil is for hay or pasture. This soil generally provides a good site for a dugout farm pond. (Capability unit Vw–24; woodland suitability group 7)

Shapleigh Series

In the Shapleigh series are somewhat excessively drained, shallow, strongly acid soils in glacial till. Their native vegetation was oak, red maple, hemlock, and white pine. They occur on the tops and sides of gently sloping to steep hills and mountains. These soils developed in material derived from granite, gneiss, and schist. Stones and boulders occur throughout the profile. Depth to bedrock ranges from 12 to 24 inches; it averages about 18 inches. In many places bedrock crops out.

The texture of the surface layer is sandy loam. The subsoil is sandy loam or loamy sand. A large acreage of Shapleigh soils is rocky or very rocky.

In Merrimack County, Shapleigh soils are not mapped separately, but in a complex with Gloucester soils. Shapleigh soils make up about 70 percent of the complex. They developed where the soil material that covers the irregular and wavy boundary of the bedrock is thinner, and the Gloucester soils developed where it is thicker (more than 24 inches deep). In this complex the Gloucester soils are in small areas so intermingled with areas of Shapleigh soils that it was not feasible to separate them on a map of the scale used. The Gloucester soils are described under the Gloucester series.

Shapleigh soils also occur near the Acton and Paxton soils. They are well drained in contrast to the moderately well drained, sandy Acton soils. In contrast to the well-drained, loamy Paxton soils, Shapleigh soils do not have a pan layer.

Water moves rapidly through the sandy Shapleigh soils. Because they are shallow to bedrock, Shapleigh soils do not hold adequate moisture for plants during dry periods.

Typical profile of Shapleigh very rocky sandy loam, 8 to 15 percent slopes—

A00—2 inches to ½ inch, recent accumulation of leaves and twigs.

A0—½ inch to 0, partly decomposed leaves and twigs.

A1—0 to 1 inch, very dark grayish-brown (10YR 3/2) sandy loam; coarse fragments 2 percent by volume and ¼ inch to 2 inches across; weak, fine, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. ½ to 1 inch thick.

B21—1 inch to 8 inches, yellowish-brown (10YR 5/6) sandy loam; coarse fragments 10 percent by volume and ¼ inch to 2 inches across; weak, medium, granular structure; friable; roots common; strongly acid; boundary clear, wavy. 8 to 10 inches thick.

B22—8 to 17 inches, olive-yellow (2.5Y 6/6) gravelly loamy sand; coarse fragments 25 percent by volume and ¼ inch to 2 inches across; weak, medium, granular structure; friable; roots common; strongly acid; boundary clear, wavy. 8 to 10 inches thick.

C—17 to 22 inches, light yellowish-brown (2.5Y 6/4) gravelly loamy sand; coarse fragments 40 percent by volume and ¼ inch to 2 inches across; weak, medium, granular structure; friable; few roots; strongly acid; boundary abrupt, irregular. 5 to 7 inches thick.

Dr—22 inches, granite bedrock.

In most places the texture of the surface layer is sandy loam, but in a few it is fine sandy loam or loamy sand. Where the soil has been plowed or otherwise disturbed, the color of the surface layer is dark brown or dark yellowish brown. In most places the C horizon is thin, but in some it is absent.

Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes (SgB).—The soils of this complex are less sloping, have fewer outcrops of bedrock, and have fewer stones on the surface than Shapleigh very rocky sandy loam, 8 to 15 percent slopes. Profiles of the Shapleigh soil and of the Gloucester soil are much like those described for the respective series. Outcrops of bedrock occur on these soils in places but do not prevent cultivation. The hazard of erosion is moderate.

These soils are suitable for cultivated crops, hay, and pasture. On long slopes, field strips, contour strips, and diversion ditches help to control the loss of soil and water. (Capability unit IIe–56; woodland suitability group 6)

Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes (SgC).—The soils of this complex have fewer stones and rock outcrops than the Shapleigh-Gloucester very rocky sandy loams. Profiles of each of the soils are like those described as representative of the respective series. There are not enough rock outcrops on these soils to prevent cultivation. These strongly sloping soils, however, must be protected from erosion.

The soils of this unit are suitable for cultivated crops, hay, and pasture. Row crops can be safely grown where the soils are smooth enough for diversion ditches, field strips, contour strips, and other erosion control practices. If stripcropping cannot be practiced, the best use of these soils is for hay or pasture. (Capability unit IIIe–56; woodland suitability group 6)

Shapleigh-Gloucester very rocky sandy loams, 3 to 15 percent slopes (ShC).—The Shapleigh soil in this complex has a profile like the one described for the Shapleigh series. This complex of soils is gently sloping to strongly sloping, and outcrops of bedrock prevent cultivation. Soils are thinner and therefore more droughty than those of the Shapleigh-Gloucester sandy loams. The soils are suitable for permanent pasture and woodland. (Capability unit VIs–57; woodland suitability group 6)

Shapleigh-Gloucester very rocky sandy loams, 15 to 25 percent slopes (ShD).—Except that it is very strongly sloping, this unit is similar to Shapleigh-Gloucester very rocky sandy loams, 8 to 15 percent slopes. Rock outcrops prevent cultivation. Because slopes are very strong and rock outcrops are numerous, these soils are best suited to woodland or pasture. The soils are thinner and more droughty than Shapleigh-Gloucester sandy loams and are generally less fertile than the more gently sloping Shapleigh-Gloucester soils. Access to these soils is generally more difficult than to the less sloping Shapleigh-Gloucester soils. (Capability unit VIs–57; woodland suitability group 6)

Shapleigh-Gloucester extremely rocky sandy loams, 8 to 25 percent slopes (SoD).—The soils of this complex are similar to Shapleigh-Gloucester very rocky sandy loams, 8 to 15 percent slopes, but they have more rock outcrops, more stones on the surface, and slopes of as much as 25 percent. This extremely rocky Shapleigh-Gloucester unit occurs on the sides of hills and mountains. Because of many rock outcrops and the shallow depth, these soils are suitable only for woodland, wildlife, or recreation. Small areas may be used occasionally for pasture. Because the soils are very thin, their moisture-holding capacity is low, plant nutrients leach rapidly, and trees grow slowly. (Capability unit VIIs–58; woodland suitability group 8)

Shapleigh-Gloucester extremely rocky sandy loams, 25 to 60 percent slopes (SoE).—Except that they are much steeper, have more rock outcrops, and have more stones on the surface, the soils of this unit are similar to Shapleigh very rocky sandy loams, 8 to 15 percent slopes. These steep and very steep, extremely rocky soils occur on the steepest hillsides and mountainsides in the county. The many rock outcrops and the shallow depth limit the use of these soils to woodland, wildlife, or recreation. Because the soils are very thin, their moisture-holding capacity is low, plant nutrients leach rapidly, and trees grow slowly. Access to these soils is generally poor. (Capability unit VIIs–58; woodland suitability group 8)

Sudbury Series

The Sudbury series consists of moderately well drained, sandy and gravelly soils on sandy outwash plains and terraces. Their native vegetation consisted of white pine, red maple, hemlock, red oak, and gray birch. These soils occur in depressions in nearly level and gently sloping areas. They have developed in water-sorted material derived from granite, gneiss, and schist.

The surface layer is dark yellowish-brown fine sandy loam; the subsoil is yellowish-brown fine sandy loam or gravelly sandy loam mottled brown; and the substratum is mottled grayish-brown sand. The Sudbury soils are strongly acid to medium acid.

Sudbury soils are not so well drained as the Merrimac soils or the excessively drained Hinckley soils, which contain more sand and gravel. Sudbury soils have the same natural drainage as the Ninigret soils but are coarser textured and contain gravel. They are better drained than the poorly drained Au Gres soils, which are nearby. They have natural drainage similar to that of the Duane soils and developed in the same parent material. Duane soils, however, have a redder subsoil and, in places, a gray layer between the surface layer and the subsoil.

The Sudbury soils have a high water table during wet periods. In places they receive seepage from higher areas. Water moves through these soils rapidly after the water table is lowered. There is generally enough moisture for plant growth during dry periods, but excess water early in the spring and during wet periods delays the use of the soils. These level to gently sloping soils are fairly easy to work, as they have no stones. Artificial drains, especially tile, work well.

Typical profile of Sudbury fine sandy loam, 0 to 3 percent slopes—

A00—3 inches to 1 inch, undecomposed white pine needles.

A0—1 inch to 0, partly decomposed white pine needles.

A1—0 to 3 inches, dark yellowish-brown (10YR 3/4) fine sandy loam; gravel 2 percent by volume; weak, fine, granular structure; friable; many roots; strongly acid; boundary clear, wavy. 2 to 3 inches thick.

B21—3 to 6 inches, yellowish-brown (10YR 5/4) fine sandy loam; gravel 5 percent by volume; weak, fine, granular structure; friable; many roots; strongly acid; boundary clear, wavy. 3 to 4 inches thick.

B22g—6 to 27 inches, brown (10YR 5/3) gravelly sandy loam; gravel 20 percent by volume; few, fine, faint, strong-brown (7.5YR 5/6) mottles in lower part; weak, fine, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 19 to 22 inches thick.

Cg—27 to 52 inches, grayish-brown (2.5YR 5/2) sand; many, coarse, distinct, strong-brown (7.5YR 5/6) mottles; single grain (structureless); loose; few roots; medium acid.

The texture of the surface layer in most places is fine sandy loam, but in a few it is sandy loam or loamy sand. Depth to mottling varies but is generally below 12 to 15 inches. The depth to gravel varies widely but is usually within 30 inches of the surface. The amount of gravel is also variable.

Sudbury fine sandy loam, 0 to 3 percent slopes (SuA).—This soil has a profile similar to the one described for the Sudbury series. The erosion hazard is slight on this nearly level soil. Cultivated crops, hay, and pasture are suitable, but artificial drainage improves this soil for corn and truck crops. (Capability unit IIw–22; woodland suitability group 2)

Sudbury fine sandy loam, 3 to 8 percent slopes (SuB).—Except that it is gently sloping, this soil is similar to Sudbury fine sandy loam, 0 to 3 percent slopes. The hazard of erosion is moderate. On long slopes, graded strips help to prevent erosion. This soil is suitable for cultivated crops, hay, and pasture, but artificial drainage improves it for corn and truck crops. (Capability unit IIw–22; woodland suitability group 2)

Suncook Series

The Suncook series consists of nearly level, excessively drained, sandy soils on flood plains. The native vegetation consisted of elm, red maple, and willow. In most places these soils occur as narrow strips bordering streams, but in some places they are broader. These droughty, coarse-textured soils are in recent water-sorted deposits derived from granite, schist, and gneiss. In some places Suncook soils are frequently flooded, but in others they are seldom flooded.

The surface layer is brown loamy sand; the underlying layers are pale-brown, very dark grayish-brown, and brown loamy sand and sand. The Suncook soils are medium to strongly acid.

These soils are sandier and hold less moisture than the well drained Ondawa, the moderately well drained Podunk, the poorly drained Rumney, and other soils on flood plains.

The Suncook soils on low bottoms have more moisture than those on high bottoms because the water table is closer to the surface. These sandy soils, however, have a low moisture-holding capacity. They dry out early in spring, as water drains downward very rapidly. They have no stones, cobbles, or gravel to interfere with tillage.

Typical profile of Suncook loamy sand—

Ap 0 to 6 inches, brown (10YR 5/3) loamy sand; weak, fine, granular structure; very friable; many roots; strongly acid; boundary abrupt, smooth. 6 to 8 inches thick.

C1—6 to 8 inches, pale-brown (10YR 6/3) medium sand; single grain (structureless); loose; many roots; medium acid; boundary abrupt, smooth. 1 to 2 inches thick.

C2—8 to 11 inches, brown (10YR 5/3) loamy sand; weak, medium, granular structure; very friable; roots common; medium acid; boundary abrupt, smooth. 3 to 4 inches thick.

C3—11 to 13 inches, brown (10YR 5/3) medium sand; single grain (structureless); loose; roots common; medium acid; boundary abrupt, smooth. 2 to 3 inches thick.

C4—13 to 16 inches, dark-brown (10YR 3/3) loamy sand; weak, medium, granular structure; very friable; roots common; medium acid; boundary abrupt, smooth. 3 to 4 inches thick.

C5—16 to 28 inches, brown (10YR 5/3) loamy sand; weak, medium, granular structure; very friable; few roots; medium, acid; boundary abrupt, smooth. 12 to 14 inches thick.

C6—28 to 37 inches, dark-brown (10YR 3/3) fine sandy loam; weak, fine, granular structure; very friable; few roots; medium acid; boundary abrupt, smooth. 7 to 8 inches thick.

C7—37 to 44 inches, brown (10YR 5/3) loamy sand; weak, medium, granular structure; very friable; few roots; strongly acid.

The texture of the surface layer in most places is loamy sand, but in some it is sand. Soils on low bottoms may be mottled below a depth of 24 inches. Layers of coarse sand and gravel may occur at depths below 24 inches along the smaller streams.

Suncook loamy sand (Sy).—This soil has a profile like the one described for the Suncook series. Some areas of moderately well drained loamy sand were included in mapping. Streambank erosion is a problem. This is a poor agricultural soil that requires careful management. Its suitability for cultivated crops, hay, and pasture is limited. (Capability unit IIIs-16; woodland suitability group 5)

Whitman Series

The Whitman series consists of very poorly drained soils in glacial till. Their native vegetation consisted of red maple, elm, hemlock, speckled elder, sedges, and rushes. These nearly level soils formed in depressions on uplands in material derived from granite, gneiss, and schist. They have a high water table and are saturated most of the time. Water frequently ponds on these soils. In many places these wet areas are at the head of streams.

The surface layer is very dark grayish-brown to nearly black stony loam that contains a large amount of organic matter. The underlying layers are mottled, light brownish-gray stony loam. The Whitman soils are strongly acid.

In Merrimack County, Whitman soils are not mapped separately. They are mapped with the poorly drained Ridgebury very stony soils as an undifferentiated unit. They are near the Gloucester, Paxton, and other well-drained soils in glacial till. The Whitman soils have much poorer drainage than the moderately well drained Acton and Woodbridge soils.

Because they are very poorly drained, Whitman soils are seldom used for crops or pasture. Waterlogging severely limits the kind of plants that can be grown. Aeration is restricted by a high water table that is close to the surface for long periods. Movement of water through these soils is hindered by the high water table, but it is rapid when the water table is lowered.

Typical profile of Whitman very stony loam, 0 to 3 percent slopes—

Apg—0 to 10 inches, black (10YR 2/1) stony loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, granular structure; very friable; many roots; strongly acid; boundary abrupt, wavy. 10 to 12 inches thick.

C1g—10 to 20 inches, gray (2.5Y 6/0) stony sandy loam; few, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, fine, granular structure; friable; few roots; strongly acid; boundary clear, wavy. 10 to 12 inches thick.

C2g—20 to 30 inches, light brownish-gray (2.5Y 6/2) stony sandy loam; many, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, platy structure; firm; few roots; strongly acid.

In most places the texture of the surface layer is loam, but in some it is fine sandy loam and sandy loam. The amount and thickness of organic matter in the surface layer varies considerably. In places the organic matter is nearly 1 foot thick over the mineral soil. Depth to the firm layer ranges from 12 to 24 inches.

Windsor Series

In the Windsor series are deep, sandy, excessively drained soils that have little or no gravel. Their native vegetation consisted of pitch pine, scrub oak, white pine, aspen, and gray birch. These soils occur on nearly level, sandy plains; gently sloping to moderately sloping terraces; and very steep terrace escarpments. In places they are on mounds that resemble dunes. These soils developed in water-sorted and wind-deposited sand derived from granite, gneiss, and schist.

The surface layer is yellowish-brown and light brownish-gray loamy sand, the substratum is pale-brown, light yellowish-brown, and light-gray sand. The Windsor

soils are strongly acid. In some areas these soils have no vegetation, and in other areas the original surface layer has been blown away.

The Windsor soils occur near the Hinckley soils. They have little or no gravel, whereas the Hinckley soils have gravelly layers. The Windsor soils are also near the very fine sandy loam Agawam soils but are not so fine textured. They are more sandy than the Merrimac soils, which have gravelly layers. They are excessively drained and droughty in contrast to the poorly drained, sandy Au Gres soils.

These soils are loose and sandy. Water moves through them very rapidly, and little moisture is held available to plants. Fertilizer leaches out rapidly, and large amounts are therefore needed. These soils are free of stones, and they warm early in spring.

Typical profile of Windsor loamy sand, 3 to 8 percent slopes—

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loamy sand; weak, fine, granular structure; very friable; many roots; strongly acid; boundary clear, wavy. 1 to 3 inches thick.

B21—3 to 9 inches, yellowish-brown (10YR 5/8) loamy sand; single grain (structureless); loose; roots common; strongly acid; boundary clear, wavy. 5 to 8 inches thick.

B22—9 to 15 inches, light yellowish-brown (10YR 6/4) sand; single grain (structureless); loose; few roots; strongly acid; boundary clear, wavy. 6 to 7 inches thick.

C1—15 to 50 inches, pale-yellow (2.5Y 7/4) sand; single grain (structureless); loose; strongly acid; boundary clear, wavy. 30 to 35 inches thick.

C2—50 to 62 inches, light brownish-gray (2.5Y 6/2) coarse sand; single grain (structureless); loose; few roots; strongly acid.

The texture of the surface layer in most places is loamy sand, but in some it is loamy fine sand or sand. In the valley of the Merrimack River, areas that have silt or silty clay at a depth of 6 feet or more were included in mapping.

Windsor loamy sand, 0 to 3 percent slopes (WdA).—Except that it is less sloping, this soil is similar to Windsor loamy sand, 3 to 8 percent slopes. The erosion hazard is slight. Although this soil is easy to work and can be used for cultivated crops, hay, and pasture, it requires irrigation for satisfactory yields. (Capability unit IIIs–26; woodland suitability group 5)

Windsor loamy sand, 3 to 8 percent slopes (WdB).—This soil has a profile similar to the one described for the Windsor series. The erosion hazard is moderate. This soil can be used for cultivated crops, hay, and pasture, but irrigation is needed for satisfactory yields. Fields should be plowed in field strips or contour strips to help reduce the loss of water and soil. (Capability unit IIIs–26; woodland suitability group 5)

Windsor loamy sand, 8 to 15 percent slopes (WdC).—Except that it is more sloping, this soil is similar to Windsor loamy sand, 3 to 8 percent slopes. The erosion hazard is greater than that on the less sloping soil. This soil is subject to gullying, and in most places it is cut by drains.

This soil is suitable for hay, pasture, and woodland. It is not suitable for cultivated crops; the risk of erosion is severe, and the soil is difficult to work and to irrigate. Many old fields have been planted to trees. (Capability unit IVs–26; woodland suitability group 5)

Windsor loamy sand, 15 to 60 percent slopes (WdE).—This soil is much steeper than Windsor loamy sand, 3 to 8 percent slopes; otherwise, the two soils are similar.

The surface layer of this soil is loamy sand in most places, but small areas of very fine sandy loam and silt loam were included in mapping. The underlying layers of these small areas are silty clay loam and silt loam. These areas are in the valley of the Merrimack River in the towns of Hooksett and Boscawen. Pits occur in Hooksett from which clay was dug to make bricks.

Because of steepness and a severe erosion hazard, this soil is best suited to woodland. (Capability unit VIIs–26; woodland suitability group 5)

Woodbridge Series

In the Woodbridge series are moderately well drained soils in glacial till that have a pan layer about 24 inches from the surface. Their native vegetation consisted of sugar maple, white oak, red oak, white pine, and hemlock. These soils occupy the crest of broad, nearly level to gently sloping, smooth drumlins and the moderately sloping to strongly sloping hillsides. They also occur on the lower slopes of drumlins, where seepage water comes to the surface. They developed in material derived from mica schist, gneiss, and granite. Stones and boulders occur throughout the profile. The Woodbridge soils are strongly acid to medium acid.

The surface layer is very dark grayish-brown loam; the subsoil is dark yellowish-brown fine sandy loam that is mottled light olive brown; the substratum is mottled, olive sandy loam.

The Woodbridge soils occur near the well-drained Paxton soils, which have a pan layer and occur on the sharper crests of drumlins. They are better drained than the poorly drained Ridgebury soils. The Woodbridge soils are not so sandy as the Acton soils.

Movement of water is moderate through these soils above the pan layer. In the pan it is slow. Water moves downslope above the pan layer and comes to the surface as seeps. These soils usually contain excess water during wet periods, but in dry periods they hold enough moisture for plants.

Most stones have been removed, but some have been left on the surface in places. These soils must be worked later in spring than well-drained soils. They are kept wet by a seasonally high water table that is in the upper part of the subsoil for short periods, and in the lower part and in the substratum for long periods late in fall, in winter, and early in spring. During dry periods when the water table is low, water may be perched above the compact pan layer until it moves downslope. The pan is very firm when dry, but it is less firm when moist.

Typical profile of Woodbridge loam, 0 to 8 percent slopes—

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) fine sandy loam to loam; weak, medium, granular structure; friable; many roots; strongly acid; boundary clear, wavy. 6 to 8 inches thick.

B21—7 to 12 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, medium, granular structure; friable; roots common; strongly acid; boundary clear, wavy. 4 to 6 inches thick.

B22—12 to 18 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, medium, granular structure; friable; roots

common; strongly acid; boundary clear, wavy. 5 to 7 inches thick.

B23g—18 to 26 inches, light olive-brown (2.5Y 5/4) fine sandy loam; few, fine, faint, yellowish-brown (10YR 5/8) mottles; weak, medium, subangular blocky structure that grades to platy; firm; few roots; strongly acid; boundary clear, wavy. 7 to 9 inches thick.

B24gm—26 to 33 inches, olive (5Y 4/3) sandy loam; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, thin, platy structure; very firm in place, firm when disturbed; few roots; medium acid.

The texture of the surface layer is generally loam or fine sandy loam but is sandy loam in places. The depth to the compact, platy pan layer ranges from 12 to 26 inches, but in most places it is 20 to 24 inches. Mottling generally occurs at a depth of about 15 inches. Where the pan is closer to the surface, the depth to mottling is less.

Woodbridge loam, 0 to 8 percent slopes (WoB).—This soil has a profile like the one described for the Woodbridge series. The hazard of erosion is moderate on this gently sloping soil. Stones have been removed from the surface so that modern farm machinery can be used. This soil is suitable for cultivated crops, hay, and pasture. On long slopes erosion can be reduced by diversion ditches and graded strips. This soil is often drained with tile (fig. 15) so that it can be worked sooner after wet periods. (Capability unit IIw–62; woodland suitability group 1)

Woodbridge loam, 8 to 15 percent slopes (WoC).—Except that it is more sloping, this soil is similar to Woodbridge loam, 0 to 8 percent slopes. The hazard of erosion is greater than on the less sloping soil. Stones have been removed from the surface so that modern farm machines can be used. Small areas of Woodbridge loam, 15 to 25 percent slopes, were included in mapping.

If this soil is protected by diversion ditches, it is suitable for cultivated crops, hay, and pasture. The diversion ditches are needed on long slopes to reduce surface runoff. If these ditches are not dug, hay or pasture is the most feasible use. Tile drains are often used. (Capability unit IIIe–62; woodland suitability group 1)

Woodbridge very stony loam, 0 to 8 percent slopes (WvB).—This soil is similar to Woodbridge loam, 0 to 8 percent slopes, but it has more stones on the surface. The stones interfere with modern farm equipment and limit the use of this soil to permanent pasture or to woodland. (Capability unit VIs–72; woodland suitability group 1)

Woodbridge very stony loam, 8 to 15 percent slopes (WvC).—This soil is more sloping and has more stones on the surface than Woodbridge loam, 0 to 8 percent slopes. The stones on this strongly sloping soil interfere seriously with the use of modern farm equipment. Areas of Woodbridge very stony loam, 15 to 25 percent slopes, were included in mapping. Because of the number of stones, this soil is best suited to permanent pasture or to woodland. If stones were removed and the soil cultivated, erosion would be more serious than on the less sloping soil. (Capability unit VIs–72; woodland suitability group 1)

***Figure 15.*—Tall stakes at left show the location of a line of tile installed to remove excess water. The soil is Woodbridge loam, 0 to 8 percent slopes.**

Formation and Classification of Soils

This section has three main parts. The first part tells how the factors of soil formation affected the soils of Merrimack County. The second part describes the classification of soils into higher categories, and lists the great soil groups and soil series represented in the county. In the third part, the profiles of six representative soils are described, and the results of laboratory determinations are shown in a table.

Factors of Soil Formation

The characteristics of the soil depend on five major factors of soil formation. They are (1) the physical and mineral composition of the parent material; (2) the climate under which the parent material has accumulated; (3) the plants and animals living in and on the soil; (4) the relief or lay of the land; and (5) the length of time that climate and living organisms have acted on the parent material.

Soils are natural bodies that occupy space on the landscape. They are continuous bodies except on bare rock and in areas covered by water. Each soil is a three-dimensional body that has length, width, and depth.

Soil is developed by interrelated processes of nature working on parent material over a period of time. Two major steps in soil development are the accumulation of parent material and the differentiation of horizons in the soil profile (*8*). In Merrimack County glaciers transported much of the parent material to the places where the soils then were formed.

Weathering and biochemical processes are constantly altering the parent material. These changes are re-

flected in the soil horizons that gradually develop as a soil is formed. In describing the soils, the soil scientist assigns a letter symbol to each of the various horizons, or layers in the soil profile. The letter tells other scientists something about the horizon and how it probably was formed.

The A horizon is the uppermost layer in the soil profile. If it is thick enough, it is mixed to form the surface soil of a plowed field. The amount of organic matter and number of living organisms are greatest in this horizon. In most places the upper part of it is the darkest colored part of the soil. Because the A horizon is the surface layer, it receives rainwater first and is subject to the greatest amount of leaching.

Immediately below the A horizon in many soils is the B horizon. The amount of organic matter and the number of living organisms are smaller in the B horizon than in the A horizon. In most places in Merrimack County, the B horizon contains accumulations of iron and aluminum oxides, along with some organic matter, that have all been leached from the A horizon and deposited in the B. The color of the B horizon is generally lighter than that of the A horizon but darker than that of the C horizon below. Many azonal soils do not have a B horizon, and their subsoil is part of the C horizon.

The C horizon, if one is present, lies under the B horizon. It consists of material presumed to be like that from which the A and B horizons developed. The amount of organic matter and the number of living organisms in this horizon are smaller than in the B horizon. In Merrimack County the parent materials of soils have mostly been transported and deposited by glacial ice, by water flowing from melting glaciers, or by wind.

Parent material

The soils in Merrimack County developed largely in glacial till and glacial outwash. Some, however, developed in small areas of glaciolacustrine sediments, some formed in sediments deposited by streams, and a few consist of organic material that accumulated in depressions.

Glacial till consists of mixed materials that were deposited by glaciers and had little or no sorting by water. In this county the soils in glacial till occur mainly in the uplands. The till is of variable thickness and was formed many years ago when the area was covered by glacial ice. As the glaciers moved slowly along, they picked up rocks and ground some of them into particles the size of sand, silt, and clay. Some fragments of rock were not ground into fine particles but were carried along by the ice. When the climate became warmer, the ice melted and the mixed materials were left. In most places the glacial till in this county is very stony.

Glacial outwash, or water-sorted material, likewise was a result of glacial action. As the glaciers melted, torrents of water were released and flowed from the melting ice. This water picked up soil, gravel, and small stones and carried them varying distances. The coarser particles settled first and were deposited in beds of sand and gravel, which are called glacial outwash. The finer particles, silt and clay, remained suspended in the water. Some were later deposited in the quiet water of glacial lakes. After the glaciers melted, the land area was uplifted and the silts and clays of glaciolacustrine sediments were exposed.

Much of the glacial material was transported only a short distance, and the irregular contour of the underlying bedrock partly determined the distribution of the parent material from which the soils developed. The bedrock of Merrimack County is metamorphic rock in some places and igneous rock in others. The metamorphic rocks are mainly pyritiferous or micaceous schist and gneiss. The igneous rocks are mainly granite or granitelike rocks. The geologic pattern was made even more complex by the mixing of the materials dragged over the bedrock by the glaciers.

Soils formed in recently deposited materials occur along streams. The streams in the nearly level areas often overflow and deposit sediments carried by the floodwaters on the low-lying areas nearby. These areas are called flood plains.

Climate

The effect of climate on soil formation depends largely on temperature, rainfall, and humidity. In Merrimack County weathering is limited to about a 7-month period when the soil is not frozen. Chemical reactions and the removal of soluble materials by leaching are restricted during the winter season. Physical weathering is most active in the spring and fall when the soil is alternately freezing and thawing. The weathering processes in this county are much slower than in places that have higher temperatures and more rainfall.

Living organisms

Plants have had a major part in the development of the soils in Merrimack County; animals have influenced development to a lesser extent. Forest was the natural vegetation. Organic matter from decaying parts of trees, and plant nutrients brought up by tree roots have influenced soil formation.

The three natural forest zones in Merrimack County are: (1) Transition Hardwoods-White Pine-Hemlock; (2) Northern Hardwoods-Hemlock-White Pine; and (3) Spruce-Fir-Northern Hardwoods (*11*). There are many different kinds of trees because a large part of the county is in the transitional zone between the central hardwood forest and the northern hardwoods. Oak, hickory, hemlock, white ash, black cherry, basswood, red maple, pitch pine, red pine, and white pine originally grew in the transition zone. Chestnut was important until it was exterminated by blight. There was a large amount of white pine. The type of soil, drainage, and climate somewhat determine the distribution and dominance of the species of trees.

Bacteria, fungi, and other micro-organisms play an important role in breaking down complex organic compounds into simpler forms. Animals have influenced soil development by mixing the soil and by adding organic matter. Earthworms are very active in mixing soil material in moderately well drained soils, and woodchucks and other burrowing animals bring soil material from the B horizon to the surface. Also, many insects eat organic matter and help reduce it to a simpler form.

Relief

Relief, or lay of the land, affects soil formation by its influence on natural drainage and runoff. There is much runoff from steep slopes and little from nearly level areas. Drainage is rapid on mountainsides and

slow on level plains. The major topographic features in Merrimack County are: (1) the valley of the Merrimack River, (2) sand plains, (3) rounded hills, and (4) low mountains.

The Merrimack River is formed within the county a few miles from the northern boundary by the confluence of the Pemigewasset and Winnipesaukee Rivers and flows from north to south through the east-central part. The valley of the Merrimack River is the widest in the county. Its widest point (about 1½ miles) is at Concord. In other places it is narrowed by steep terraces and upland slopes. Its elevation is more than 300 feet near the northern boundary of the county and less than 200 feet at Hooksett in the southern part.

The sand plains occur near the valley of the Merrimack River at an elevation about 100 feet above the valley floor. There is little runoff and slow drainage from these level sandy plains. Most of the water enters the soil and percolates through it.

The rounded hills are adjacent to the valley of the Merrimack River and other valleys. These hills are in the southern and eastern parts of the county and are generally less than 1,000 feet high.

The elevation of the uplands in the low mountains in the northern and western parts of the county is generally more than 1,000 feet. This area also has rounded hills, but they are higher than the hills adjacent to the valleys. Mountains in this part of the county are 2,937 feet at their highest peak. Slopes are steeper in this mountainous area than in other areas. Also, a large amount of runoff occurs, and drainage is rapid from the mountainsides.

Some of the most prominent mountains and their elevations are Mount Kearsarge, 2,937 feet; Sunapee Mountain, 2,743 feet; and Ragged Mountain, 2,225 feet.

Time

Time is needed for soil to form. Mineral weathering is controlled largely by the length of time the weathering processes have been acting. Gains, losses, transfers, and alterations in the soil horizons require time. The development of soil horizons is related to the length of time the parent material has been subjected to the other soil-forming factors.

Soils in Merrimack County that are in glacial till, in lacustrine deposits, in water-sorted sand, and in wind-deposited sand have been in place long enough to have well-developed profiles and are mature. Soils in recent alluvium are young and do not have developed profiles. These soils receive or lose sediments with each flood and have not been in place long enough for a profile to form.

Scientists estimate that, in this county, it would take from 500 to 1,000 years for soil horizons to develop. During that time the soil would have to remain in place with no material added.

Classification of Soils

Soils that have similar characteristics are classified, or grouped into classes in six categories to facilitate the understanding of the many different kinds of soils. Beginning with the highest, the six categories are the order, suborder, great soil group, family, series, and type.

Soils with selected characteristics in common are grouped into lower categories commonly recognized in the field, namely, soil series and type. In the lowest category of natural soil classification, the soil type, thousands of kinds of soil are recognized in the United States. These soil types are divided into phases if they have a range in characteristics that affect their use.

In the highest category, all the soils in the country are grouped into three orders—zonal, intrazonal, and azonal soils. Within the order are great soil groups, and within the great soil groups are soil series.

The zonal order consists of those great soil groups that contain soils with well-developed characteristics that reflect the influence of climate and living organisms, chiefly vegetation. In Merrimack County the great soil groups in the zonal order are Brown Podzolic soils and Podzols.

The intrazonal order consists of those great soil groups that have soils with characteristics that reflect the dominant influence of some local factor of relief or parent material over the effect of climate and living organisms. The intrazonal soils in this county are members of the Bog, Ground-Water Podzol, Humic Gley, and Low-Humic Gley great soil groups.

The zonal order consists of soils that lack well-developed profile characteristics reflecting the influence of age. Some factor or factors prevented the development of normal soil profile characteristics. Azonal soils in this county are members of the Alluvial great soil group.

A great soil group consists of soils that have the same general kind of profile. The soil series in Merrimack County, arranged by the seven great soil groups and three soil orders in which they are classified, are listed as follows:

Order and great soil group	*Series*
Zonal—	
Brown Podzolic	Acton, Agawam, Belgrade, Gloucester, Hinckley, Merrimac, Ninigret, Paxton, Shapleigh, Sudbury, Windsor, Woodbridge.
Podzols	Canaan, Colton, Duane, Hermon.
Intrazonal—	
Bog	Muck and Peat.[1]
Ground-Water Podzols	Au Gres.
Humic Gley	Saco, Scarboro, Whitman.
Low-Humic Gley	Limerick, Ridgebury.
Azonal—	
Alluvial soils	Ondawa, Podunk, Rumney, Suncook.

[1] In this county Muck and Peat were not classified in soil series.

In Merrimack County the soils have also been grouped by catenas, which is a different grouping that is useful in explaining their formation. A soil catena consists of a group of soils that developed from the same kind of parent material under the same climatic conditions, but these soils are differentiated by characteristics resulting from differences in relief and drainage. Drainage in some catenas ranges from very poor to excessive. The soils in a catena are generally close to one another in the field. Table 10 shows how the soils in the county are grouped into catenas.

TABLE 10.—*Soil catenas in Merrimack County*

[Great soil groups are designated thus: (A)—Alluvial, (B)—Bog, (BP)—Brown Podzolic, (GWP)—Ground-Water Podzol, (HG)—Humic Gley, (LHG)—Low-Humic Gley, and (P)—Podzol]

Parent material	Excessively drained; deep	Somewhat excessively drained; deep or shallow over bedrock	Well drained; deep	Moderately well drained; deep	Poorly drained; deep [1]	Very poorly drained; deep
Recent acid alluvium mainly from granite, granitic gneiss, and mica schist. (Flood plain)	Suncook (A)	--	Ondawa (A)	Podunk (A)	Rumney (A)	Saco (HG).
	--	--	--	--	Limerick (LHG).	
Glaciofluvial deposits of ice-contact and proglacial material:						
1. Stratified sand and gravel mainly from granite, granitic gneiss, and some mica shist. (Glacial outwash)	Hinckley (BP).	Merrimac (BP)	--	Sudbury (BP)	Au Gres (GWP).	Scarboro (HG).
	Colton (P)	--	--	Duane (P)	Au Gres (GWP).	Scarboro (HG).
2. Sandy deposits from granite, granitic gneiss, and some mica schist with little or no gravel. (Stream terraces and glacial outwash)	Windsor (BP).	--	Agawam (BP).	Ninigret (BP).	Au Gres (GWP).	Scarboro (HG).
Glaciolacustrine deposits of silt, fine sand, and clay. (Glacial lake or slack water deposits)	--	--	--	Belgrade (BP).	--	--
Glacial till:						
1. Sandy material mainly from granite, granitic gneiss, and some mica schist. (Uplands)	--	Gloucester (BP).	--	--	--	--
	--	Hermon (P)	--	--	--	
	--	Shapleigh (BP).[2]	Gloucester (BP).	Acton (BP)	Ridgebury (LHG).	Whitman (HG).
	--	Canaan (P)[2]	Hermon (P)	--	Ridgebury (LHG).	Whitman (HG).
2. Loamy material mainly from mica schist and some granite. (Uplands)	--	--	Paxton (BP)	Woodbridge (BP).	Ridgebury (LHG).	Whitman (HG).
Organic deposits:[3]						
1. Slightly decomposed to well-decomposed plant remains over 12 inches in depth.	--	--	--	--	--	Muck and Peat (B).

[1] Includes the lower range of somewhat poorly drained class.
[2] Shallow soil over bedrock.
[3] In this county Muck and Peat were not classified in soil series.

Brown Podzolic soils

The Brown Podzolic great soil group covers a larger area and contains more soil series than any other group in the county. This group includes excessively drained, somewhat excessively drained, well drained, and moderately well drained soils.

Soils in this group formed as a result of podzolization. Their development probably took place in the following manner. Water percolated through the organic layer of leaves that covered the mineral soil under a mixed forest and carried away the organic acids. These acids combined with iron and aluminum that were leached out of the mineral particles in the surface layer. These sesquioxide-humus compounds were moved downward only short distances, and then they precipitated out and adhered to the outside of the mineral particles in the B horizon. These compounds colored the mineral particles of the B horizon a strong brown or yellowish brown. The B horizon has a stronger color at the top because the concentration of the coated particles is greater there. Deeper in the profile, the soil colors are weaker.

Most of the iron and aluminum comes from the A1 horizon. The leaching does not cause the A1 horizon to become lighter colored, because only small amounts of iron and aluminum are leached out and because earthworms, ants, beetles, mice, spiders, thrips, and other small animal life mix the upper B horizon, A1 horizon, and the organic mat.

The upper part of the solum of Brown Podzolic soils in Merrimack County ranges in texture from silt loam to loamy sand. The structure is weak, medium granular, and the consistency is friable. The texture of the lower part of the solum may be coarser and sandier than that of the upper part, or it may be about the same. Structure and consistence, however, vary considerably in the lower part. Structure may be single grain (structureless), granular, or platy; consistence ranges from loose to very firm.

A fragipan occurs in the lower part of the solum of the Paxton and Woodbridge soils. The pan layer has high bulk density; it is very firm and brittle when dry but is less firm when moist. The structure is platy in the fragipan. The material below the fragipan in the Paxton and Woodbridge soils is massive (structureless), compact, and very firm. Examination of the particle-size distribution shows no significant difference between the friable material above the fragipan and the material in the fragipan (*4*).

Podzols

The soils of the Podzol great soil group have developed as the result of severe leaching. At high elevations the climate is cooler and the vegetation includes more conifers under which leaching is more intense. As a result, a light-gray A2 horizon, or bleicherde, is formed. The color of the upper part of the B horizon is reddish brown and is called an orterde layer. If the bleicherde and orterde layers become so thick that either is apparent even after the soil has been plowed, the soils are called Podzols.

A summary of the major processes in the development of Podzols follows: (a) Bases are leached from the solum and the soil becomes strongly acid; (b) under forests, organic matter accumulates as a mor horizon on the surface; (c) sesquioxides move out of the A2 horizon, probably as organic complexes; and (d) sequioxides, especially iron, with humus accumulate in the upper part of the B horizon as an orterde or ortstein layer. The strongest development of Podzol characteristics in Merrimack County has occurred in the Canaan, Colton, and Hermon soils.

Bog soils

The soils of the Bog great soil group in this county consist of Muck and Peat mapped together. These soils are composed of deposits of organic matter from plant remains. These deposits are more than 12 inches thick and have accumulated in depressions that are always wet. The plant remains consist mainly of sedges, rushes, mosses, shrubs, and trees. To some extent they have been preserved from oxidation and decay by the water.

In Peat soils organic matter has undergone less decomposition than in Muck soils, and in many places the original plant can be identified. Organic matter in Muck soils, however, has undergone complete decomposition and the original plant cannot be recognized. In places Muck soils have a high content of mineral matter.

Bog soils are not farmed in this county. Poor stands of red maple, black spruce, and alder trees, together with shrubs, mosses, rushes, and sedges, are on most of them. All of these soils are acid.

Ground-Water Podzols

The soils of the Ground-Water Podzol great soil group have developed in poorly drained, sandy material. They occur in depressions on level sandy plains and on gently sloping terraces. The Au Gres soils are the only Ground-Water Podzols mapped in Merrimack County.

Ground-Water Podzols that formed under forests have a thin A0 horizon of partly decomposed leaves. A thick, light-gray, sandy A2 horizon underlies the A0. Below the A2 horizon is a discontinuous ortstein layer composed of sand cemented by iron and organic compounds. These compounds have leached out of the A2 horizon. The accumulation of iron and organic compounds occurs at the mean ground-water level. The ortstein layer is dark reddish brown. Loose, structureless sand underlies the firm, cemented layer.

Humic Gley soils

In the Humic Gley great soil group are very poorly drained soils that formed in places where the soil is saturated except during the driest periods. The surface layer is black to very dark gray, is 5 to 10 inches thick, and contains a large amount of organic matter.

The soil-forming process was gleization, a process that involves saturation of the soil for long periods of time in the presence of organic matter. In this process air is excluded from the soil and iron becomes chemically reduced. Reduced iron compounds are soluble and can be transferred. The B horizon is gray, or if partly aerated, it is gray mottled with yellowish brown or yellowish red.

In Merrimack County the Saco, Scarboro, and Whitman soils are in the Humic Gley great soil group.

Low-Humic Gley soils

Most of the poorly drained mineral soils of this county belong to the Low-Humic Gley great soil group. These soils have developed under the influence of a fluctuating water table. They have a thin, dark-gray or very dark gray surface layer and distinct gray, yellowish, or strong-brown mottling in the lower horizons. The layer of organic matter on the surface is thin.

The soil-forming process in the development of Low-Humic Gley soils is gleization. Gleying takes place when leaves, needles, or other organic matter is incorporated into a soil that is saturated for a long time. In this process air is excluded from the soil, and oxygen is used up by bacteria. Lack of oxygen causes iron to be chemically reduced and made soluble. The change of the highly colored ferric iron compounds to the reduced form produces grayish hues in the B horizon.

In many soils the organic matter, or its soluble products that are needed for the gleying process, remains in the upper part of the soil. Therefore, the lower part of the soil retains the original color of the parent material, even though it is saturated completely for long periods.

Because the water table is high except during the growing season, very little water percolates through the Low-Humic Gley soils, and, therefore, leaching is not extensive. Because of less intensive leaching, the Low-Humic Gley soils commonly have a slightly higher base saturation than the associated Brown Podzolic soils. Generally, the wetter soils of a catena are considerably less acid throughout than soils that have been subjected to leaching. In this county the soils of the Limerick and Ridgebury series are in the Low-Humic Gley great soil group.

Alluvial soils

The soils of the Alluvial great soil group are excessively drained to very poorly drained and are on flood plains. They are composed of recently deposited sediments, and, therefore, have little or no horizon development. They frequently receive additional sediments from floodwaters.

The Suncook, Ondawa, Podunk, and Rumney soils belong to the Alluvial great soil group. Soils of the Suncook series are excessively drained to moderately well drained, and are coarser textured than the well drained Ondawa soils. The Rumney soils are more poorly drained

than the Ondawa and Podunk soils. The Rumney soils are distinctly mottled.

Miscellaneous land types

A few mapping units are miscellaneous land types and are not members of a soil series. It is not feasible to classify these areas, as they have little natural soil. The land types mapped in Merrimack County are Gravel pits, Made land, Marsh, Mixed alluvial land, Riverwash, and Rock outcrop.

Laboratory Data

Samples for laboratory determinations were taken, by horizons, from selected soils of four soil series, the Agawam, Au Gres, Paxton, and Ridgebury. One site each was sampled for the Agawam and Au Gres series, and two each for the Paxton and Ridgebury.

The analyses were made by standard methods used by the Soil Survey Laboratories of the Soil Conservation Service. The physical and chemical properties of the soils sampled are shown in table 11.

A description of the horizons sampled in each soil follows. Unless otherwise stated, all colors given in the descriptions are for moist soil.

Profile of Agawam very fine sandy loam, S57NH-7-3-(1-7).—Sampled in an idle field, 300 yards southeast of junction of State Route 3A and U.S. Highway No. 3, on east side of Merrimack River.

Ap—0 to 9 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; weak, medium, granular structure; friable; many roots; pH 5.4; abrupt, smooth boundary; 8 to 9 inches thick.

B21—9 to 13 inches, brownish-yellow (10YR 6/8) very fine sandy loam; weak, medium, subangular blocky structure that breaks to single grain (structureless); very friable; many roots; worm channels; pH 5.6; clear, wavy boundary; 3 to 5 inches thick.

B22—13 to 24 inches, yellow (10YR 7/8) very fine sandy loam; weak, medium, subangular blocky structure that breaks to single grain (structureless); very friable; common roots; pH 6.0; clear, wavy boundary; 10 to 11 inches thick.

C1—24 to 31 inches, yellow (2.5Y 7/6) loamy very fine sand; weak, medium, subangular blocky structure that breaks to single grain (structureless); very friable; common roots; slight leaching; pH 6.0; clear, wavy boundary; 6 to 7 inches thick.

C2g—31 to 38 inches, pale-yellow (2.5Y 7/4) loamy fine sand with very faint mottles; weak, medium, granular structure; very friable; few roots; pH 6.0; abrupt, smooth boundary; 7 to 8 inches thick.

C3g—38 to 49 inches, yellow (2.5Y 8/6) fine sand; many, medium, prominent yellowish-red (5YR 5/6) mottles; weak, medium, subangular blocky structure that breaks to single grain (structureless); very friable; few roots; distinct dark-red (2.5YR 3/6) iron bands 1 to 5 millimeters thick; pH 6.2; clear, wavy boundary; 10 to 11 inches thick.

C4g—49 to 63 inches, light-gray (2.5Y 7/2) very fine sand with a silty feel; many, medium, prominent dark-red (2.5YR 3/6) mottles; weak, medium, subangular blocky structure that breaks to single grain (structureless); friable; pH 5.4; clear, wavy boundary; 13 to 14 inches thick.

D—63 to 69 inches +, coarse gravel over coarse sand (not sampled).

Profile of Au Gres loamy sand, S59NH-7-1-(1-9).—Sampled on Webber farm on Graham Road in East Concord.

Ap—0 to 7 inches, very dark gray (10YR 3/1) loamy sand; weak, fine, granular structure; very friable when moist; many roots; few, faint, strong-brown root stains in root channels; boundary abrupt, smooth; 6 to 8 inches thick. Some evidence A2 is mixed with the Ap.

A21—7 to 10 inches, gray (N 5/0) loamy sand; weak, fine, granular structure; very friable when moist; many roots; boundary abrupt, wavy; 2 to 4 inches thick.

A22—10 to 15 inches, gray (10YR 6/1) medium sand; massive (structureless) in place, breaks to single grain (structureless), when disturbed; very friable when moist; roots common; boundary abrupt, smooth with a ½-inch band of dark grayish-brown fine sand; 4 to 6 inches thick.

B1—15 to 19 inches, dark-brown (10YR 4/3) medium sand; single grain (structureless); loose when moist; few roots; occasional bleached and coated sand grains; boundary clear, smooth; 3 to 5 inches thick.

B21—19 to 25 inches, dark reddish-brown (5YR 3/4) medium sand; weak, fine, granular structure; firm in place, very friable when disturbed and moist; no roots; boundary abrupt, smooth; 5 to 7 inches thick.

B22m—25 to 31 inches, dark reddish-brown (5YR 3/3) medium sand; weak, fine, granular structure; very firm in place, firm to friable when disturbed and moist; bands of cemented coarse sand; boundary abrupt, smooth; 5 to 7 inches thick.

B23—31 to 39 inches, dark-brown (7.5YR 3/2) sand; massive (structureless) in place, single grain (structureless) when disturbed; firm in place, loose when disturbed and moist; boundary clear, smooth; 7 to 9 inches thick.

B24—39 to 65 inches, dark-brown (7.5YR 3/2) medium sand; massive (structureless) in place, single grain (structureless) when disturbed; friable in place, loose when disturbed and moist; boundary clear, wavy; 24 to 28 inches thick.

C—65 to 75 inches +, dark-gray (5Y 4/1) medium sand; single grain (structureless); loose when moist.

Profile of Paxton fine sandy loam, S56NH-71-(1-7).—Sampled in a hayfield, approximately three-quarters of a mile east of Hart Hill on the Usilka farm, about 200 feet east of town road (dirt) and 300 yards north of farmhouse.

Ap—0 to 9 inches, dark-brown (10YR 3/3) fine sandy loam with 5 to 10 percent coarse material; weak, medium, subangular blocky structure that breaks to weak, fine, granular structure; very friable; many fine roots; strongly acid; clear, wavy boundary; 8 to 10 inches thick.

B21—9 to 15 inches, light olive-brown (2.5Y 5/4) fine sandy loam with 10 to 20 percent coarse material; weak, medium, subangular blocks averaging 1 to 2 inches across; friable; many fine to medium roots; medium acid; clear, wavy boundary; 5 to 6 inches thick.

B22 15 to 21 inches, olive-brown (2.5Y 4/4) fine sandy loam with 20 to 25 percent coarse material; weak, medium, subangular blocks averaging 1 inch across; friable; many fine to medium roots; medium acid; clear, wavy boundary; 5 to 7 inches thick.

B3—21 to 25 inches, olive-brown (2.5Y 4/4) fine sandy loam with 5 to 10 percent coarse material; weak, medium, subangular blocks averaging 1 inch across that break to weak, fine, granules; friable; few roots; medium acid; abrupt, wavy boundary; 3 to 5 inches thick.

B′21m—25 to 34 inches, olive-brown (2.5Y 4/4) loam with 25 to 35 percent coarse material; peds have grayish-brown (2.5Y 5/2) coatings; moderate, thick, platy structure; fine glazed pores common on outside of plates; very firm; medium acid; diffuse boundary; 8 to 10 inches thick. Pocket of fine sand, approximately 8 inches thick by 14 inches wide, at 25-inch depth, not sampled as part of horizon.

B′22m—34 to 43 inches, dark grayish-brown (2.5Y 4/2) loam with 25 to 35 percent coarse material; grayish-brown (2.5Y 5/2) coatings on peds; dark-brown manganese stains on many peds; moderate, thick, platy structure; fine glazed pores common on outside of plates; very firm; medium acid; arbitrary boundary.

B′23m—43 to 52 inches, similar to B′22m horizon.

TABLE 11.—*Physical and chemical*

Soil type and sample number	Depth	Horizon	Particle size distribution										Bulk density
			Very coarse sand (2.0-1.0 mm.)	Coarse sand (1.0-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)	Clay (less than 0.002 mm.)	0.2-0.02 mm.	0.02-0.002 mm.	Greater than 2 mm.	
	Inches		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Gm. per cc.*
Agawam very fine sandy loam: S57NH-7-3-(1-7).	0-9	Ap	0. 3	0. 6	1. 6	20. 3	39. 8	35. 8	1. 6	81. 9	8. 2	<1	1. 18
	9-13	B21	. 0	. 2	1. 4	26. 3	42. 4	28. 9	. 8	85. 4	5. 7	0	1. 27
	13-24	B22	. 0	. 2	1. 0	17. 5	41. 4	39. 0	. 9	85. 7	7. 8	0	1. 24
	24-31	C1	. 0	. 3	2. 6	27. 2	43. 7	25. 7	. 5	82. 4	4. 3	0	1. 25
	31-38	C2g	. 0	. 2	3. 5	39. 9	35. 6	20. 2	. 6	78. 4	3. 7	0	1. 30
	38-49	C3g	. 0	. 4	7. 5	42. 6	31. 1	17. 8	. 6	68. 1	2. 9	0	1. 36
	49-63	C4g	. 0	. 6	3. 6	28. 5	35. 7	30. 8	. 8	77. 5	7. 0	0	1. 36
Au Gres loamy sand: S59NH-7-1-(1-9).	0-7	Ap	2. 2	10. 1	14. 5	30. 3	20. 3	19. 6	3. 0	50. 8	6. 2	<1	1. 28
	7-10	A21	1. 0	8. 7	12. 6	27. 5	21. 1	26. 7	1. 5	55. 8	7. 4	<1	1. 74
	10-15	A22	. 7	13. 2	21. 2	41. 6	16. 4	6. 3	. 6	44. 4	1. 6	<1	1. 60
	15-19	B1	1. 2	11. 3	19. 0	43. 1	22. 3	2. 3	. 8	49. 7	. 0	<1	1. 61
	19-25	B21	1. 0	18. 5	20. 7	32. 5	22. 5	4. 3	. 5	45. 0	1. 7	<1	1. 67
	25-31	B22m	2. 9	20. 4	29. 1	31. 1	11. 9	4. 0	. 6	29. 4	. 6	<1	1. 67
	31-39	B23	8. 7	26. 4	30. 1	21. 5	8. 6	. 3	. 8	16. 7	. 8	<1	1. 62
	39-65	B24	3. 6	21. 9	24. 3	32. 6	9. 9	7. 0	. 7	29. 9	1. 7	<1	1. 67
	65-75+	C	1. 0	11. 5	25. 9	50. 2	9. 5	. 3	1. 6	33. 8	. 3	<1	------
Paxton fine sandy loam: S56NH-7-1-(1-7).	0-9	Ap	5. 6	10. 6	9. 9	20. 0	14. 4	32. 1	7. 4	40. 3	17. 2	19	------
	9-15	B21	5. 4	10. 8	9. 8	21. 7	15. 5	31. 5	5. 3	44. 1	15. 4	12	------
	15-21	B22	6. 6	12. 0	9. 2	19. 6	14. 9	30. 8	6. 9	40. 8	16. 3	16	------
	21-25	B3	6. 2	12. 0	8. 8	17. 9	13. 7	33. 9	7. 5	38. 5	19. 4	12	------
	25-34	B'21m	5. 2	11. 0	9. 1	19. 8	15. 9	30. 5	8. 5	41. 2	16. 9	10	------
	34-43	B'22m	4. 6	10. 4	8. 6	18. 2	14. 4	33. 3	10. 5	39. 9	18. 6	14	------
	43-52	B'23m	5. 4	11. 9	9. 3	18. 4	15. 4	31. 9	7. 7	40. 2	17. 9	10	----
Paxton fine sandy loam: S56NH-7-2-(1-7).	0-7	Ap	2. 5	9. 2	9. 1	19. 0	18. 9	35. 9	5. 4	50. 0	15. 7	6	------
	7-12	B21	3. 0	8. 9	8. 9	19. 2	20. 9	35. 6	3. 5	53. 6	13. 6	10	------
	12-17	B22	3. 7	9. 6	9. 1	19. 3	19. 7	36. 2	2. 4	53. 8	13. 2	19	------
	17-21	A'2m	4. 3	11. 1	9. 7	19. 5	18. 7	34. 4	2. 3	51. 0	13. 0	7	------
	21-33	B'21m	4. 3	16. 8	11. 9	20. 2	16. 2	27. 0	3. 6	41. 8	12. 7	23	------
	33-45	B'22m	4. 9	14. 5	10. 1	18. 4	17. 2	30. 6	4. 3	44. 3	14. 4	8	------
	45-60	B'23m	4. 8	13. 1	9. 2	18. 3	17. 5	33. 0	4. 1	46. 9	14. 5	5	----
Ridgebury loam: S59NH-7-5-(1-7).	0-9	Ap	4. 2	8. 6	8. 3	14. 8	19. 2	39. 4	5. 5	50. 8	16. 1	5	1. 22
	9-14	A2g	4. 1	8. 9	9. 0	15. 3	20. 0	39. 4	3. 3	53. 4	14. 4	11	1. 48
	14-18	B21g	6. 9	17. 2	16. 7	24. 8	16. 4	16. 4	1. 6	39. 0	6. 7	16	1. 62
	18-22	B22g	7. 6	15. 6	14. 1	23. 2	18. 3	19. 4	1. 8	42. 0	8. 3	19	1. 80
	22-31	B31gm	6. 6	17. 2	15. 8	23. 6	16. 8	18. 3	1. 7	39. 9	7. 6	26	1. 96
	31-49	B32gm	7. 6	17. 6	15. 8	22. 1	15. 4	19. 5	2. 0	37. 4	8. 8	22	2. 03
	49-69+	C	6. 2	15. 5	13. 2	19. 5	16. 6	22. 9	6. 1	38. 2	11. 7	14	2. 00
Ridgebury loam: S59NH-7-6-(1-8).	0-8	Ap	6. 2	15. 5	13. 2	19. 5	16. 6	22. 9	6. 1	38. 2	11. 7	14	1. 24
	8-12	B21g	8. 3	17. 0	14. 3	20. 9	14. 5	22. 5	2. 5	38. 2	9. 6	25	1. 55
	12-23	B22g	7. 1	16. 1	14. 8	24. 3	18. 6	18. 0	1. 1	42. 6	7. 0	25	1. 73
	23-35	B23g	8. 9	18. 6	15. 2	23. 2	17. 1	16. 4	. 6	40. 1	5. 9	22	1. 89
	35-37	B24gm	5. 2	13. 8	12. 5	20. 3	16. 9	27. 8	3. 5	41. 5	14. 1	10	2. 10
	37-52	B31gm	6. 5	17. 2	14. 3	21. 5	16. 6	21. 1	2. 8	39. 9	9. 6	11	1. 98
	52-60	B32gm	6. 4	14. 0	12. 0	19. 6	18. 0	27. 6	2. 4	44. 0	12. 4	10	1. 98
	60-73+	Cg	6. 0	14. 8	13. 2	20. 5	16. 2	23. 5	5. 8	39. 2	11. 5	9	2. 02

properties of selected soils

Moisture held at— 1/10 atmos.	Moisture held at— 1/3 atmos.	Moisture held at— 15 atmos.	pH H_2O 1:1 ratio	pH 1 N KCl 1:1 ratio	Organic carbon	Nitrogen	C/N ratio	Free iron oxide (Fe_2O_3)	Free aluminum oxide Al_2O_3	Aluminum extractable with KCl	Cation exchange capacity (sum)	Extractable cations (Meq./100 gm.) Ca	Mg	H	Na	K	Base saturation
Percent	*Percent*	*Percent*			*Percent*	*Percent*		*Percent*	*Percent*	*Meq./100 gm.*	*Meq./100 gm.*						*Percent*
34.6	16.3	5.2	5.2	------	1.56	0.110	14	1.0	------	------	13.4	1.0	0.2	12.0	0.03	0.13	10
30.0	19.3	2.9	5.6	------	.38	.034	11	.7	------	------	6.2	.6	.1	5.4	.01	.05	13
33.3	14.4	2.2	5.7	------	.32	------	------	.6	------	------	4.5	.4	.1	3.9	.05	.06	13
27.1	16.1	1.2	6.0	------	.14	------	------	.5	------	------	2.9	.3	.1	2.4	.03	.06	17
20.7	9.9	1.1	5.9	------	.11	------	------	.6	------	------	2.3	.2	.1	1.9	.02	.04	17
20.8	15.5	1.1	6.0	------	.08	------	------	.5	------	------	1.8	.2	.1	1.5	.03	.03	17
19.0	16.9	1.1	5.9	------	.06	------	------	.6	------	------	1.8	.2	<.1	1.5	.02	.08	17
22.2	------	8.2	4.5	4.3	3.12	255	12	<.1	0.2	0.1	15.1	4.7	.8	9.4	.11	.05	38
15.5	------	1.3	4.8	4.1	.17	------	------	<.1	.1	.3	2.1	.7	.1	1.2	.06	.02	43
6.2	------	1.2	4.9	5.5	.08	------	------	<.1	.1	.2	.9	.2	<.1	.6	.04	.02	33
4.4	------	.8	5.0	4.5	.14	------	------	<.1	.2	.3	1.4	.3	<.1	1.0	.06	.02	28
4.6	------	.9	5.1	4.5	.27	------	------	<.1	.2	.3	4.2	.4	<.1	3.7	.05	.03	12
5.1	------	1.6	5.0	4.4	.46	.037	12	<.1	.4	.4	5.7	1.1	<.1	4.5	.05	.04	21
5.5	------	1.0	5.2	4.5	.38	.034	11	<.1	.3	.3	4.9	1.1	.1	3.6	.04	.02	26
5.8	------	1.0	5.1	4.6	.29	------	------	<.1	.2	.3	4.2	.5	.1	3.5	.05	.04	17
2.8	------	.5	4.0	3.9	.13	------	------	<.1	.2	2.6	4.4	.3	.1	3.9	.05	.06	11
29.6	19.5	8.6	5.2	------	2.50	.190	13	1.6	------	------	18.0	2.8	.1	14.7	.1	.2	18
26.0	14.9	5.0	5.4	------	.60	.052	12	1.4	------	------	9.0	.5	.1	8.2	.1	.1	9
24.8	15.8	4.5	5.6	------	.41	.037	11	1.2	------	------	8.0	.8	.1	6.8	.1	.2	15
21.6	16.1	4.2	5.7	------	.28	.024	------	1.2	------	------	6.7	.7	.1	5.6	.1	.2	16
17.2	12.7	4.7	5.4	------	.10	.015	------	1.3	------	------	5.9	.8	.1	4.8	.1	.2	19
20.5	14.1	5.8	5.1	------	.05	.015	------	1.3	------	------	5.6	.7	.1	4.6	.1	.2	18
18.4	13.6	5.0	5.0	------	.05	.012	------	1.3	------	------	5.6	.7	.2	4.4	.1	.2	21
------	------	------	5.0	------	3.13	.257	12	1.7	------	------	20.4	1.6	.3	18.1	.1	.3	11
------	------	------	5.2	------	1.24	.113	11	1.3	------	------	12.0	.6	.1	11.1	.1	.2	8
------	------	------	5.4	------	.63	.061	10	1.3	------	------	8.1	.4	.1	7.4	.1	.1	9
------	------	------	5.5	------	.21	.018	------	.5	------	------	5.8	.5	.1	5.0	.1	.2	14
------	------	------	5.6	------	.10	.012	------	.6	------	------	5.2	.5	.2	4.2	.1	.2	19
------	------	------	5.8	------	.05	.008		.6	------	------	4.4	.4	.1	3.6	.1	.3	18
------	------	------	6.0	------	.05	.006	------	.6	------	------	4.8	.7	.1	3.6	.1	.3	25
38.2	------	8.4	5.7	5.0	2.66	.220	12	.7	------	.1	15.8	3.8	.2	11.6	.08	.14	27
28.7	------	2.5	5.7	4.6	.66	.058	11	.2	------	.6	6.4	.6	.1	5.6	.06	.09	12
9.9	------	1.4	5.8	4.9	.37	.036	10	.2	------	.2	4.6	.1	<.1	4.3	.05	.10	6
10.3	------	1.6	5.8	5.0	.29	------	------	.4	------	.1	5.4	.3	.1	4.8	.06	.09	11
9.6	------	1.3	5.8	5.0	.18	------	------	.6	------	.1	4.1	.1	.1	3.7	.11	.10	10
10.5	------	.8	6.0	5.1	.04	------	------	.4	------	<.1	1.4	<.1	<.1	1.2	.07	.09	14
12.5	------	3.0	6.1	4.8	.02	------	------	.5	------	<.1	1.8	.1	.3	1.2	.10	.13	33
35.3	------	10.2	5.5	4.1	3.51	.284	12	.9	------	.2	20.3	3.6	.2	16.2	.10	.22	20
15.5	------	2.8	6.0	5.2	.61	.068	9	.5	------	<.1	7.9	.9	.1	6.8	.09	.14	15
11.3	------	1.6	6.1	5.4	.20	------	------	.2	------	<.1	4.4	.3	.1	3.9	.09	.09	11
8.5	------	.7	6.0	5.1	.04	------	------	.2	------	<.1	1.7	.1	.1	1.4	.09	.08	18
12.5	------	2.0	6.1	5.0	.04	------	------	.3	------	<.1	2.3	.3	.1	1.6	.07	.19	30
10.6	------	1.9	6.1	5.0	.02	------	------	.5	------	.1	2.3	.6	.1	1.4	.07	.14	39
13.8	------	1.6	6.2	5.0	.02	------	------	.5	------	.1	2.2	.7	.1	1.3	.08	.13	45
12.7	------	3.6	6.1	4.8	.02	------	------	.5	------	.1	4.2	1.5	.3	2.1	.08	.19	50

Profile of Paxton fine sandy loam, S56NH-7-2-(1-7).—Sampled in hayfield on L. L. Leighton farm on east side of East Pleasant Street in Franklin, one-quarter of a mile south of farmhouse, and approximately 500 yards from crest of hill.

Ap—0 to 7 inches, dark-brown (10YR 3/3) fine sandy loam with 5 to 10 percent coarse material; weak, fine, granular structure; very friable; many fine roots; strongly acid; clear, wavy boundary; 6 to 7 inches thick.

B21—7 to 12 inches, dark yellowish-brown (10YR 4/4) fine sandy loam with 5 to 10 percent coarse material; weak, medium, subangular blocks, ½ to 1½ inches across, that break to weak, fine granules; friable; many fine roots; medium acid; clear, wavy boundary; 5 to 7 inches thick.

B22—12 to 17 inches, olive-brown (2.5Y 4/4) fine sandy loam with 15 to 25 percent coarse material; weak, medium, subangular blocks, ½ to 1½ inches across, that break to weak, fine granules; many fine to medium roots; medium acid; abrupt, wavy boundary; 4 to 6 inches thick.

A'2m—17 to 21 inches, olive (5Y 5/3) fine sandy loam with 15 to 25 percent coarse material; weak, medium, platy structure; clean sand grains around plates indicate eluviation downslope through this horizon.

B'21m—21 to 33 inches, olive-gray (5Y 4/2) fine sandy loam with 15 to 25 percent coarse material; peds have grayish-brown (2.5Y 5/2) coatings; moderate, thin, platy structure; fine glazed pores common on outside of plates; firm; few roots; medium acid; diffuse boundary; 12 inches thick.

B'22m—33 to 45 inches, olive (5Y 4/3) fine sandy loam with 20 to 30 percent coarse material; peds have grayish-brown (2.5Y 5/2) coatings; moderate, thin, platy structure; fine glazed pores common on outside of plates; firm; medium acid.

B'23m—45 to 60 inches, olive (5Y 4/3) fine sandy loam with 20 to 30 percent coarse material; peds have grayish-brown (2.5Y 5/2) coatings; moderate, thin, platy structure; fine glazed pores common on outside of plates; firm; medium acid.

Profile of Ridgebury loam, S59NH-7-5-(1-7).—Sampled in idle field, one mile northeast of church on U.S. Highway No. 3, Pembroke (Suncook Quadrangle).

Ap—0 to 9 inches, very dark brown (10YR 2/2) loam; weak, fine, granular structure; very friable; many roots; clear, wavy boundary; 8 to 11 inches thick.

A2g—9 to 14 inches, light brownish-gray (2.5Y 6/2) sandy loam with pockets of loamy sand to sand and fine sandy loam; common, fine, distinct, strong-brown (7.5YR 5/6) and red (2.5YR 4/8) mottles; weak, thick, platy structure; friable; few roots; clear, wavy boundary; 4 to 7 inches thick.

B21g—14 to 18 inches, light olive-brown (2.5Y 5/4) loamy sand with 4 percent fine gravel; many, coarse, distinct, yellowish-red (5YR 5/8), strong-brown (7.5YR 5/8), and olive (5Y 5/3) mottles; weak, medium, granular structure; friable; few roots; clear, wavy boundary; 3 to 5 inches thick.

B22g—18 to 22 inches, light yellowish-brown (2.5Y 6/4) fine gravelly sandy loam with pockets of coarse sand; many, coarse, distinct, dark reddish-brown (2.5YR 3/4) and strong-brown (7.5YR 5/8) mottles; weak, thick, platy structure; firm in place, firm to friable when disturbed; clear, wavy boundary; 3 to 6 inches thick.

B31gm—22 to 31 inches, light yellowish-brown (2.5Y 6/4) fine gravelly loamy sand; many, coarse, distinct, dark reddish-brown (2.5YR 2/4) and yellowish-red (5YR 4/8 and 5/8) mottles; massive in place, discontinuous, moderate, thick, platy structure when disturbed; firm; clear, wavy boundary; 8 to 11 inches thick.

B32gm—31 to 49 inches, light yellowish-brown (2.5Y 6/4) fine gravelly sand or loamy sand; many, coarse, distinct, dark-red (2.5YR 3/6), strong-brown (7.5YR 5/8), and olive (5Y 5/3) mottles; massive in place, weak, thick, platy structure when disturbed; firm; clear, wavy boundary; 15 to 19 inches thick.

C—49 to 69 inches +, grayish-brown (2.5Y 5/2) loamy sand with 5 percent fine gravel; weak, medium, platy structure; firm in place, friable when disturbed.

Profile of Ridgebury loam, S59NH-7-6-(1-8).—Sampled on Gooden farm, 20 yards west of intersection, top of Pembroke Hill (Suncook Quadrangle).

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam with 1 percent coarse material; few, fine, faint, yellowish-brown (10YR 5/8) and grayish-brown (2.5Y 5/2) mottles; weak, medium, granular structure; friable; many roots; clear, wavy boundary; 7 to 8 inches thick.

B21g—8 to 12 inches, light yellowish-brown (2.5Y 6/4) loamy sand with 4 percent coarse material; common, medium, distinct, strong-brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; weak, fine, granular structure; friable; roots common; clear, wavy boundary. 4 to 5 inches thick.

B22g—12 to 23 inches, light brownish-gray (2.5Y 6/2) loamy sand with 8 to 10 percent coarse material; common, fine, distinct, yellowish-red (5YR 5/8) and strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure that breaks to weak, fine, granular structure; firm in place, friable when disturbed; roots few; clear, wavy boundary; 10 to 11 inches thick.

B23g—23 to 35 inches, pale-olive (5Y 6/3) gravelly loamy sand; common, fine, distinct, yellowish-red (5YR 4/6 and 5/8) and strong-brown (7.5YR 5/6) mottles; weak, thick, platy structure; firm to friable; clear, wavy boundary; 10 to 11 inches thick.

B24gm—35 to 37 inches, gray (5Y 6/1) fine sandy loam with 2 to 3 percent coarse material; common, medium, distinct, yellowish-red (5YR 4/8) and strong-brown (7.5YR 5/6) mottles; massive (structureless); firm; clear, wavy boundary; 2 to 3 inches thick.

B31gm—37 to 52 inches, light olive-brown (2.5Y 5/4) loamy sand with 8 to 10 percent coarse material; common, medium, distinct, red (2.5YR 4/8), yellowish-red (5YR 5/8), and strong-brown (7.5YR 5/6) mottles; massive in place, weak, thick, platy structure when disturbed; firm; clear, wavy boundary; 14 to 15 inches thick.

B32gm—52 to 60 inches, light yellowish-brown (2.5Y 6/4) loamy sand, with 2 percent coarse material; common, medium, distinct, yellowish-red (5YR 5/8) and strong-brown (7.5YR 5/8) mottles; massive in place, weak, thick, platy structure when disturbed; firm; clear, wavy boundary; 7 to 8 inches thick.

Cg—60 to 73 inches +, olive-gray (5Y 5/2) sandy loam with 3 percent fine gravel; few, fine, faint, strong-brown (7.5YR 5/8) mottles; moderate, medium, platy structure in upper part, tendency toward platiness in lower part but more friable; firm.

Additional Facts About the County

In this section settlement and development of Merrimack County are discussed. Information is also given about climate, agriculture, industry and population, transportation, and recreation.

Settlement and Development

The first settlement in the county was made at Concord, in about 1727, by Puritan families from Haverhill, Mass. The settlement was named Pennycook. At that time the area was inhabited by the Penacook Indians, who had headquarters at what is now the village of Penacook. The regions around the Merrimack River and its tributaries were their favorite hunting and fishing grounds (*6*).

This new settlement was the frontier. Settlers cleared away the forests and developed a self-sufficing economy. There was little demand for surplus products. Most

things the farm family needed were either grown or made on the family farm. The land was new, and soils were cleared with little thought of their capabilities. From the time of settlement to 1830, the population increased at the fastest rate in its history. Merrimack County was formed in 1823 from parts of the adjoining counties (*5*).

In the period 1830 to 1870, the peak of rural population and agricultural development was reached and passed. The transition from subsistence farming to commercial farming occurred early in this period. In fact, by the 1850's subsistence farming had ended (*12*). Pioneer farmers made their living by raising grain and beef cattle, sheep, and other livestock, but by 1870 practically all farmers were specializing in dairying, poultry farming, or orcharding. The change in type of farming eliminated many submarginal farms having fields not suited to the use of farm machinery. The attraction of new, fertile land farther west was another cause of the rural decline.

Dairying and poultry farming are still the leading agricultural enterprises. Fruit farms (apples), livestock farms, vegetable farms, and general farms are also important. Most of the milk produced in Merrimack County is sold locally, but some reaches the Boston market. Poultry products are one of the leading sources of farm income. Market eggs, hatching eggs, and broilers are sold.

Climate [5]

Moderately warm summers, cold winters, and ample rainfall are characteristic of the climate of Merrimack County. The Atlantic Ocean, which is about 30 to 70 miles to the southeast, occasionally affects the weather. The prevailing winds are from the northwest, though winds from the southwest are nearly as frequent in summer. The climate, therefore, is influenced much more by air coming from the land than by air coming from the ocean. As is typical of a dominantly continental climate, temperatures vary widely from winter to summer and also from day to night. Variation in temperature from day to day is also common, as the county is near the normal path of weather systems that alternately bring in warmer air from a southerly direction and colder air from a northerly direction.

The elevation and local topography also affect weather. At higher elevations, average temperatures are generally lower and precipitation is higher. Elevations range from about 200 to 500 feet above sea level along the Merrimack River. Elsewhere in the county, most urban and agricultural areas generally range from 500 to 1,000 feet in elevation; many hills in these areas, however, are considerably higher. Much of the western part of the county is higher than 1,000 feet. The highest elevation is at the top of Mount Kearsarge, which is 2,937 feet. Except for relatively flat plains in river valleys, the county is predominantly hilly.

The variations in climate within the county that are caused by different distances from the Atlantic Ocean and by different elevations are generally too small to be readily reflected in changes in the type of agriculture. Local topography, especially as it affects spring and fall freezes, and the soil type may have more bearing on the selection of the kinds and varieties of crops. Hay and pasture are the principal crops grown, mainly because of the large dairy industry. Tree fruits, especially apples, and truck crops are also grown.

Stations of the U.S. Weather Bureau are located at Blackwater Dam, Bradford, Concord, Franklin, and South Danbury. Precipitation data only are recorded at the Bradford and South Danbury stations; the Blackwater Dam and Franklin stations record both precipitation and daily maximum temperature. At the Municipal Airport in Concord, the U.S. Weather Bureau records precipitation and temperature and makes other detailed observations.

The Blackwater Dam station is 1 mile south-southwest of the Webster post office, in an open grassy plot of a rolling to hilly, moderately forested, rural area. Several ponds and streams are nearby. The Bradford station is 1.2 miles south-southwest of the Bradford post office, on a slight rise among open fields in a generally hilly and forested area. The Concord station is at the Municipal Airport, 1.0 mile east of the post office in an open, mostly level to gently rolling area, about 0.6 mile east of the Merrimack River. The Franklin station is 0.7 mile north-northeast of the West Franklin post office, in a residential area that is somewhat hilly and moderately forested. The South Danbury station is 0.8 mile south of the South Danbury post office, in hilly to mountainous country, with a few farms and many forested areas. The weather at these stations, except that at Concord, is therefore generally representative of the weather in rural areas. The weather at the Concord station is more affected by urban conditions. The data for the nearest weather station may not necessarily be most applicable to other points in the county. Best results may be obtained by using data from a station that is similar in topography, elevation, and environment.

In table 12 are temperature (when available) and precipitation data from five weather stations. These tables do not give the highest and lowest temperatures ever recorded, but rather a probability of the occurrence of specified temperatures. For planning purposes, these probabilities may be more useful than the recorded extremes. In general, however, the monthly maxima and minima, averaged over a long period of time, differ only slightly from the tabular values shown for the high and low temperatures that are likely to occur on at least 4 days of the month in at least 2 years out of 10. That is, these values may also be used as an estimate of the extremes to be expected for the given month each year.

Temperature.—The mean monthly temperature is 55° F. or higher for each of the five months, May through September. The mean temperature, of the coldest month, January, is less than 23°; it is probably less than 20° at the highest elevations. The mean July temperature is near, or just under, 70°. Although in an average summer the temperature reaches 90° on only 13 days or less, the year-to-year frequency ranges from only a few or none in an occasional cool summer to many more than the average in a warm summer. Nights are almost always cool, even in the warmest summer.

[5] Written by ROBERT E. LAUTZENHEISER, State climatologist, U.S. Weather Bureau, Boston, Massachusetts.

TABLE 12.—*Temperature and precipitation for five weather stations*

[Dashes indicate data are not available]

BLACKWATER DAM (WEBSTER), N.H. ELEVATION, 480 FEET

Month	Temperature: Average daily: Maximum	Temperature: Average daily: Minimum	Temperature: Average daily: Mean	Temperature: Two years in 10 will have at least 4 days with—: Maximum temperature equal to or higher than—	Temperature: Two years in 10 will have at least 4 days with—: Minimum temperature equal to or lower than—	Precipitation: Average monthly total	Precipitation: One year in 10 will have—: Less than—	Precipitation: One year in 10 will have—: More than—	Precipitation: Average snowfall	Precipitation: Days with—: Snowfall 1 inch or more	Precipitation: Days with—: Snow cover 1 inch or more	Precipitation: Days with—: Precipitation 0.10 inch or more
	°F.	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Inches			
January	33. 2	11. 7	22. 5	48	−9	3. 57	1. 3	5. 7	17. 4	6	27	8
February	35. 9	12. 7	24. 3	50	−8	2. 97	1. 5	4. 0	18. 2	6	28	7
March	41. 0	21. 3	31. 2	54	2	3. 49	1. 5	5. 1	16. 3	5	24	8
April	56. 5	32. 9	44. 7	73	21	3. 46	2. 0	4. 8	3. 1	1	5	8
May	68. 3	41. 7	55. 0	85	30	3. 30	2. 0	4. 7	(1)	0	0	7
June	77. 5	51. 5	64. 5	91	39	3. 32	1. 6	4. 6	0	0	0	7
July	82. 0	55. 9	69. 0	93	45	3. 41	1. 6	5. 5	0	0	0	6
August	79. 3	54. 4	66. 9	91	44	2. 82	1. 1	4. 5	0	0	0	6
September	72. 4	46. 9	59. 7	87	32	3. 50	1. 1	5. 8	0	0	0	6
October	62. 1	36. 5	49. 3	76	21	3. 04	1. 4	5. 4	. 1	(2)	0	6
November	48. 7	28. 5	38. 6	64	16	4. 14	2. 5	5. 8	4. 0	1	2	8
December	35. 2	16. 5	25. 9	52	−5	3. 60	1. 2	6. 0	14. 7	5	17	7
Year	57. 7	34. 2	46. 0	[3] 94	[4] −16	40. 62	31. 6	52. 7	73. 8	24	103	84

BRADFORD, N.H. ELEVATION, 1,000 FEET

Month	Maximum	Minimum	Mean	Max. ≥	Min. ≤	Average monthly total	Less than—	More than—	Average snowfall	Snowfall 1 inch or more	Snow cover 1 inch or more	Precipitation 0.10 inch or more
January	-------	-------	-------	-------	-------	3. 43	1. 7	5. 6	21. 3	6	27	0
February	-------	-------	-------	-------	-------	3. 06	2. 0	4. 0	20. 8	5	27	6
March	-------	-------	-------	-------	-------	3. 37	1. 7	5. 7	17. 7	5	25	7
April	-------	-------	-------	-------	-------	3. 75	2. 2	5. 5	6. 2	2	7	8
May	-------	-------	-------	-------	-------	3. 94	1. 9	7. 4	. 6	(2)	(2)	9
June	-------	-------	-------	-------	-------	3. 81	1. 7	6. 5	0	0	0	7
July	-------	-------	-------	-------	-------	3. 52	1. 8	5. 4	0	0	0	7
August	-------	-------	-------	-------	-------	3. 32	1. 6	5. 6	0	0	0	7
September	-------	-------	-------	-------	-------	3. 90	1. 4	9. 2	0	0	0	6
October	-------	-------	-------	-------	-------	3. 05	1. 0	6. 4	. 1	(2)	(2)	6
November	-------	-------	-------	-------	-------	4. 48	2. 6	6. 6	5. 6	2	4	7
December	-------	-------	-------	-------	-------	3. 73	1. 6	5. 6	15. 9	4	20	6
Year	-------	-------	-------	-------	-------	43. 36	34. 7	53. 6	88. 2	24	110	76

CONCORD, N.H. ELEVATION, 339 FEET

Month	Maximum	Minimum	Mean	Max. ≥	Min. ≤	Average monthly total	Less than—	More than—	Average snowfall	Snowfall 1 inch or more	Snow cover 1 inch or more	Precipitation 0.10 inch or more
January	31. 7	10. 6	21. 2	47	−12	3. 23	1. 7	5. 7	18. 3	5	25	7
February	33. 5	11. 8	22. 7	49	−6	2. 48	1. 5	3. 4	13. 1	4	25	6
March	41. 7	21. 7	31. 7	58	4	3. 26	1. 3	5. 6	11. 6	3	19	7
April	55. 9	31. 7	43. 8	76	22	3. 31	1. 6	5. 0	2. 0	1	1	7
May	69. 3	41. 6	55. 5	86	29	3. 17	1. 6	5. 9	. 3	(2)	(2)	7
June	77. 7	51. 3	64. 5	91	40	3. 60	1. 5	6. 0	0	0	0	7
July	82. 8	56. 4	69. 6	93	46	3. 41	1. 4	5. 6	0	0	0	7
August	80. 6	54. 1	67. 4	93	43	2. 96	1. 1	5. 4	0	0	0	6
September	72. 4	46. 2	59. 3	87	32	3. 75	. 9	7. 7	0	0	0	6
October	61. 4	35. 6	48. 6	78	25	2. 66	. 7	4. 7	(1)	0	(2)	5
November	47. 9	27. 2	37. 6	65	16	3. 72	1. 5	6. 6	3. 6	1	2	7
December	35. 1	14. 8	25. 0	53	−7	3. 25	1. 0	5. 5	12. 7	3	15	6
Year	57. 5	33. 6	45. 6	[3] 96	[4] −19	38. 80	31. 2	48. 4	61. 6	17	87	78

See footnote at end of table.

TABLE 12.—*Temperature and precipitation for five weather stations*—Continued

[Dashes indicate data are not available]

FRANKLIN, N.H. ELEVATION 390 FEET

Month	Temperature					Precipitation						
	Average daily			Two years in 10 will have at least 4 days with —		Average monthly total	One year in 10 will have—		Average snowfall	Days with—		
	Maximum	Minimum	Mean	Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		Snowfall 1 inch or more	Snow cover 1 inch or more	Precipitation 0.10 inch or more
	°F.	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Inches			
January	31. 2	10. 6	20. 9	45	−12	3. 30	1. 4	5. 4	20. 2	5	26	7
February	33. 1	11. 3	22. 2	45	−8	2. 67	1. 6	4. 0	15. 7	5	26	6
March	41. 7	20. 8	31. 3	58	1	3. 23	1. 3	5. 5	12. 0	4	22	7
April	56. 1	31. 5	43. 8	75	21	3. 51	1. 8	5. 1	3. 3	1	2	8
May	69. 8	41. 7	55. 8	85	29	3. 94	1. 7	6. 4	. 1	(2)	0	8
June	78. 6	51. 6	65. 1	91	39	3. 68	1. 4	6. 4	0	0	0	7
July	83. 2	57. 1	70. 2	92	46	3. 65	1. 8	5. 1	0	0	0	7
August	80. 7	55. 0	67. 9	92	43	2. 99	1. 2	5. 3	0	0	0	6
September	72. 3	48. 0	60. 2	87	34	3. 82	1. 5	7. 8	(1)	0	0	6
October	61. 2	36. 7	49. 0	75	24	2. 99	. 9	5. 1	. 1	(2)	(2)	6
November	47. 0	27. 8	37. 4	66	14	4. 03	1. 9	6. 0	3. 5	1	2	7
December	33. 9	15. 1	24. 5	52	−6	3. 42	1. 2	6. 6	11. 1	4	15	6
Year	57. 4	33. 9	45. 7	[3] 96	−19	41. 23	31. 4	50. 0	66. 0	20	93	81

SOUTH DANBURY, N.H. ELEVATION 690 FEET

Month	Maximum	Minimum	Mean	Max. temp. equal to or higher than—	Min. temp. equal to or lower than—	Average monthly total	Less than—	More than—	Average snowfall	Snowfall 1 inch or more	Snow cover 1 inch or more	Precipitation 0.10 inch or more
January	--------	--------	--------	--------	--------	2. 96	1. 1	4. 2	19. 3	6	27	7
February	--------	--------	--------	--------	--------	2. 73	1. 6	4. 5	19. 1	6	27	6
March	--------	--------	--------	--------	--------	2. 98	1. 4	4. 7	14. 6	4	22	7
April	--------	--------	--------	--------	--------	3. 23	2. 1	4. 5	3. 5	1	6	7
May	--------	--------	--------	--------	--------	4. 02	2. 0	6. 8	. 4	(2)	(2)	9
June	--------	--------	--------	--------	--------	3. 65	1. 8	6. 1	0	0	0	7
July	--------	--------	--------	--------	--------	3. 66	1. 9	5. 7	0	0	0	7
August	--------	--------	--------	--------	--------	3. 19	1. 4	6. 4	0	0	0	6
September	--------	--------	--------	--------	--------	3. 31	1. 1	6. 8	0	0	0	5
October	--------	--------	--------	--------	--------	3. 19	1. 2	5. 9	. 1	(2)	(2)	5
November	--------	--------	--------	--------	--------	4. 24	2. 2	6. 2	4. 3	1	2	8
December	--------	--------	--------	--------	--------	3. 37	. 6	5. 6	13. 4	4	16	5
Year	--------	--------	--------	--------	--------	40. 53	31. 5	51. 2	74. 7	22	100	79

[1] Trace.
[2] Less than 1.
[3] Average annual maximum.
[4] Average annual minimum.

The mean number of days that specified temperatures occur during each month at three weather stations is given in table 13. Also shown in this table are heating degree-days and growing degree-days. Degree-days are computed by recording for each day the significant mean departure from a selected temperature base, and adding these departures for the month and for the year. The temperature selected as a base, and the selection of positive or negative departures to be recorded, depend upon the purpose of the computation. A base of 65° F. is used for heating degree-days, as this is the lowest mean daily temperature at which no heat is required in homes. To get the departure for one day, the actual mean temperature, if less than 65°, is subtracted from 65°. For example, a day with a mean temperature of 55° has a value of 10 heating degree-days. In contrast, a day with a mean temperature of 65° or more has no heating degree-days because no heat is then required. Heating degree-days are useful in calculating the amount of fuel needed in an average year and in comparing a particular season with the average. Heating degree-days are frequently used by gas, electric, and fuel companies in estimating fuel and power requirements.

Data on growing degree-days are useful for planning the data for planting and harvesting crops. Growing degree-days accumulate when the mean temperature is higher than the base, or the lowest mean temperature at which plants continue to grow and develop. They are calculated for the year by subtracting this base temperature from the actual mean temperature for the day and keeping a cumulative record of these differences. In table 13 data are calculated from two standard bases, 40° for

TABLE 13.—*Frequency of specified temperatures*

Month	Blackwater Dam station							Concord station	
	Mean number of days that—				Accumulated heat units			Mean number of days that—	
	Maximum temperature is —		Minimum temperature is—		Heating degree-days	Growing degree-days		Maximum temperature is—	
	90° F or higher	32° F or lower	32° F or lower	0° F or lower	Base 65° F	Base 40° F	Base 50° F	90° F or higher	32° F or lower
January	0	17	30	6	1, 310	0	0	0	16
February	0	11	28	5	1, 140	0	0	0	11
March	0	6	29	1	1, 040	15	0	0	4
April	(1)	(1)	15	0	600	190	40	0	(1)
May	(1)	0	4	0	310	470	185	1	0
June	2	0	(1)	0	75	740	440	3	0
July	4	0	0	0	20	905	605	5	0
August	2	0	0	0	50	840	530	3	0
September	1	0	2	0	175	600	305	1	0
October	0	0	13	0	490	300	75	0	0
November	0	1	21	0	800	85	0	0	1
December	0	12	29	4	1, 220	0	0	0	12
Year	9	47	171	16	7, 230	4, 145	2, 180	13	44

[1] Less than 1.

TABLE 14.—*Probabilities of freezing temperatures*

Probability	Blackwater Dam station					Concord station	
	Dates for given probability and temperature—					Dates for given probability and temperature—	
	32° F or lower	28° F or lower	24° F or lower	20° F or lower	16° F or lower	32° F or lower	28° F or lower
Spring:							
1 year in 10 later than.	May 31	May 20	April 28	April 15	April 5	May 27	May 19
2 years in 10 later than.	May 27	May 15	April 23	April 10	March 31	May 23	May 14
5 years in 10 later than.	May 20	May 7	April 15	April 2	March 23	May 16	May 6
8 years in 10 later than.	May 12	April 28	April 6	March 25	March 14	May 8	April 27
Fall:							
1 year in 10 earlier than.	September 14	September 21	October 5	October 14	November 7	September 15	September 21
2 years in 10 earlier than.	September 18	September 26	October 10	October 19	November 12	September 19	September 26
5 years in 10 earlier than	September 25	October 4	October 18	October 27	November 20	September 26	October 4
8 years in 10 earlier than.	October 3	October 13	October 27	November 5	November 29	October 5	October 13

grasses, potatoes, peas and other cool-season crops, and 50° for corn and other warm-season crops. Thus, a day on which the mean temperature is 60° has 20 growing degree-days for a cool-season crop but only 10 degree-days for a warm-season crop.

A substantial number of growing degree-days in a given month does not necessarily indicate that crops can be safely planted. There still may be a damaging freeze. The probability of freezing temperatures after specified dates in spring and before specified dates in fall are given in table 14. At Blackwater Dam, for example, there is 1 chance in 10 that the temperature will be 32° or lower after May 31, but 8 chances in 10 that it will be 32° or lower after May 12. The chance at this station

and averages of heating and growing degree-days

Concord station—Continued					Franklin station						
Mean number of days that—Continued		Accumulated heat units			Mean number of days that—				Accumulated heat units		
Minimum temperature is—		Heating degree-days	Growing degree-days		Maximum temperature is—		Minimum temperature is—		Heating degree-days	Growing degree-days	
32° F or lower	0° F or lower	Base 65° F	Base 40° F	Base 50° F	90° F or higher	32° F or lower	32° F or lower	0° F or lower	Base 65° F	Base 40° F	Base 50° F
30	7	1, 358	0	0	0	17	30	7	1, 360	0	0
28	5	1, 184	0	0	0	13	28	6	1, 200	0	0
27	1	1, 032	50	0	0	5	28	1	1, 040	45	0
15	0	636	170	35	[1]	0	17	0	630	170	25
4	0	298	485	200	1	0	5	0	295	595	205
0	0	75	740	440	3	0	[1]	0	75	755	455
0	0	6	920	610	5	0	0	0	10	935	625
0	0	50	855	545	3	0	0	0	35	865	555
2	0	177	585	290	1	0	1	0	180	610	310
12	0	505	285	65	[1]	[1]	11	0	490	290	75
21	0	822	60	0	0	2	21	[1]	820	55	0
29	4	1, 240	0	0	0	13	29	4	1, 250	0	0
168	17	7, 383	4, 150	2, 185	13	50	170	18	7, 385	4, 320	2, 250

after specified dates in spring and fall

Concord station—Continued			Franklin station				
Dates for given probability and temperature—Continued			Dates for given probability and temperature—				
24° F or lower	20° F or lower	16° F or lower	32° F or lower	28° F or lower	24° F or lower	20° F or lower	16° F or lower
May 3	April 21	April 10	May 29	May 24	May 7	April 25	April 9
April 28	April 16	April 5	May 25	May 19	May 2	April 20	April 4
April 20	April 8	March 28	May 18	May 11	April 24	April 12	March 27
April 11	March 31	March 19	May 10	May 2	April 15	April 4	March 18
October 4	October 15	November 5	September 15	September 23	October 4	October 16	November 3
October 9	October 20	November 10	September 19	September 28	October 9	October 21	November 8
October 17	October 28	November 18	September 26	October 6	October 17	October 29	November 16
October 26	November 6	November 28	October 4	October 15	October 26	November 7	November 25

of 32° after May 20 is 1 in 2. A temperature of 32° usually damages sensitive plants seriously, though hardier ones withstand lower temperatures. Probabilities for various lower temperatures also are given in the table.

The average length of the freeze-free season is about 140 days for much of the rural area, but it is slightly longer in some urban and protected areas. The average is somewhat shorter at higher elevations and is noticeably shorter in low areas or "frost pockets". Especially in low, boggy areas, frost may occur very late in spring and early in fall.

Precipitation.—The average annual precipitation is about 40 inches in much of the county. It is generally 40 inches or less in the lower areas in the valley of the

TABLE 15.—*Supplemental*

Month	Maximum precipitation in—				Maximum snowfall		Average relative humidity			
	24 hours	6 hours	3 hours	1 hour	Monthly	24 hours	1:00 a.m., c.s.t.	7:00 a.m., c.s.t.	1:00 p.m., c.s.t.	7:00 p.m., c.s.t.
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Percent*	*Percent*	*Percent*	*Percent*
January	2. 1	1. 2	0. 9	0. 4	33	19	76	78	60	70
February	2. 1	1. 9	1. 4	. 6	25	12	77	78	56	67
March	2. 6	1. 0	. 8	. 4	38	14	75	75	53	63
April	2. 4	1. 4	. 9	. 6	10	7	78	74	49	61
May	3. 1	1. 9	1. 4	. 3	5	5	83	74	48	63
June	4. 5	3. 8	3. 6	1. 6	0	0	87	78	51	65
July	5. 1	2. 7	2. 7	2. 7	0	0	89	80	50	68
August	3. 6	3. 2	2. 6	2. 4	0	0	90	86	52	71
September	6. 0	3. 8	2. 9	2. 0	0	0	90	88	54	76
October	4. 2	1. 6	1. 3	. 8	[1]	1	86	86	51	72
November	4. 0	3. 2	2. 0	1. 4	15	10	82	83	59	74
December	2. 8	1. 5	1. 0	. 5	38	15	78	79	58	71
Year	6. 0	3. 8	3. 6	2. 7	38	19	83	80	53	68

[1] Less than 1.

Merrimack River. Averages are above 40 inches or more in the higher parts of the county and may exceed 45 inches in the very highest. The highest weather station in Merrimack County is at Bradford, which is 1,000 feet above sea level. Precipitation at this station averages 43.36 inches per year. This figure includes the water equivalent of the snowfall.

The amount of precipitation is remarkably well distributed among the seasons. About 50 percent of the annual amount falls during the 6 warmer months. The precipitation in the county, which is relatively large compared with that of most of the Nation, provides adequate water for homes, for industry, and for irrigation during the usually short but fairly common dry periods in summer.

Snowfall varies considerably in amount from year to year and may vary markedly from place to place in a given year. The average seasonal total ranges from about 60 to 70 inches in the eastern part of the county, and from about 70 to 90 inches in the western part. A continuous snow cover of 1 month or more occurs nearly every winter except in the valley of the Merrimack River, especially in the southeastern part of the county. Here from 10 to 20 percent of the winters do not have a snow cover lasting 1 month. In the uplands, especially in the western part of the county, generally less than 5 percent of the winters fail to have a snow cover of 1 month or more. The average seasonal depth of snow ranges from about 18 inches in the southeastern part of the valley of the Merrimack River to 2 to 2½ feet in the western highlands. The average date of maximum depth is early in February at the lower elevations, and near the middle of February elsewhere. In winters with the least snow accumulation, the maximum depth ranges from 5 to 10 inches. In winters with the most accumulation the maximum depth generally ranges from 36 to 48 inches in most of the county, and from 24 to 30 inches in the southeastern part along the Merrimack River.

The seasonal occurrence of snowfall at each of the weather stations was estimated. At Blackwater Dam, snowfall amounting to 4 inches or more in one day occurs from 1 to 11 times per season and averages 6 times; 8 inches or more occurs from 0 to 5 times per season and averages 1 time; 10 inches or more occurs from 0 to 3 times per season and averages slightly more than 1 in every 2 seasons. Multiple occurrences of 10-inch snowfall can be expected 1 season in 10. At Bradford, snowfall amounting to 4 inches or more in one day occurs from 3 to 13 times per season and averages 8 times; 8 inches or more occurs from 0 to 6 times per season and averages 2 times; 10 inches or more occurs from 0 to 4 times per season and averages 1 time. Multiple occurrences of a 10-inch snowfall can be expected 1 season in 4. At Concord, snowfall amounting to 4 inches or more in one day occurs from 1 to 10 times per season and averages 5 times; 8 inches or more occurs from 0 to 2 times per season and averages 1 time; 10 inches or more occurs from 0 to 2 times per season and averages 1 time in every 2 seasons. Multiple occurrences of a 10-inch snowfall can be expected 1 season in 30. At Franklin, snowfall amounting to 4 inches or more in one day occurs from 1 to 12 times per season and averages 6 times; 8 inches or more occurs from 0 to 4 times per season and averages 1 time; 10 inches or more occurs from 0 to 2 times per season and averages 1 time in every 2 seasons. Multiple occurrences of a 10-inch snowfall can be expected 1 season in 10. At South Danbury, snowfall amounting to 4 inches or more in one day occurs from 4 to 13 times and averages 8 times; 8 inches or more occurs from 0 to 5 times per season and averages 2 times; 10 inches or more occurs from 0 to 4 times and averages about 6 in every 10 seasons. Multiple occurrences of a 10-inch snowfall can be expected 1 season in 10. For additional snowfall data see table 12.

Additional data.—Table 15 contains selected climatalogical data from the records available at Concord. These records include data on relative humidity, wind, sunshine, sky conditions, thunderstorms, and heavy fog. Some additional data on precipitation are also included. Some of the data in this table show extremes for the period of record; other data show averages. Except for maximum precipitation, the period of record was 1942 through 1961, and the observations were made only at the Munici-

climatological data

Wind			Sunshine		Sky (daytime)				Days with—		
Average speed	Prevailing direction	Fastest speed	Percent of possible	Average No. of hours daily	Percent of cloud cover	Clear	Partly cloudy	Cloudy	Precipitation 0.01 inch or more	Thunderstorms	Heavy fog
M.p.h.		*M.p.h.*				*Days*	*Days*	*Days*			
7. 3	NW.	43	48	4. 2	62	9	7	15	11	(1)	3
7. 9	NW.	42	52	5. 2	61	8	7	13	10	(1)	2
8. 2	NW.	71	49	5. 5	62	8	8	15	11	(1)	3
7. 8	NW.	52	48	6. 0	66	7	8	15	12	1	2
7. 0	NW.	48	50	6. 9	67	6	9	16	13	3	4
6. 3	NW.	38	57	8. 9	62	6	12	12	11	5	4
5. 6	NW.	37	62	9. 5	60	7	13	11	10	6	7
5. 2	NW.	56	59	8. 4	57	8	12	11	9	4	8
5. 4	NW.	42	54	6. 6	57	10	9	11	9	2	9
6. 0	NW.	39	52	5. 8	56	11	8	12	9	1	7
6. 7	NW.	72	41	3. 8	67	7	8	15	11	(1)	4
6. 9	NW.	51	47	4. 0	61	8	9	14	10	(1)	2
6. 7	NW.	72	52	6. 2	62	95	110	160	126	22	55

pal Airport station. Maximum precipitation is for the entire period of record, and the observations also included those made at the older Concord city office, beginning in 1902.

Storms.—Thunderstorms are the principal cause of damage to crops from wind and hail. They occur on an average of 20 to 25 days each year, though the number varies from year to year. Thunder may occur in any month, but it is most frequent from May through August. Most thunderstorms do little or no damage; instead they bring beneficial rain. The heavy rains that accompany the more severe thunderstorms cause soil erosion and injury to plants and probably do more damage than the associated lightning. The spring and summer thunderstorms are occasionally accompanied by hail. Hailstones may fall about once or twice a year at a given place, but the stones are seldom large enough or numerous enough to cause extensive damage. At times, however, hail may cause heavy local damage. Damaging wind or heavy rain caused by hurricanes affect Merrimack County only once in 10 years or more. Strong wind and heavy rain from coastal storms, or northeasters, are more frequent than from hurricanes, but usually they do not cause serious damage. Tornadoes have occurred in the county, but they are not common. When they do occur, only a very small area is generally affected. Personal injury and significant property damage are rare. A tornado, however, crossed both Sullivan and Merrimack Counties on September 9, 1821, and according to estimates, 25 people were killed.

Agriculture

On the following pages crops and other agricultural statistics of the county are discussed. The statistics given are from reports published by the U.S. Census Bureau.

Land use

In 1959, about 26.4 percent of the county, or 157,142 acres, was in farms. There were 903 farms in the county. The average size of farm was 174 acres. The acreage of land in farms, by use, is listed as follows:

	Acres
Cropland (total)	38, 409
Harvested	24, 121
Pastured	10, 414
Not harvested or pastured	3, 874
Woodland (total)	104, 572
Pastured	20, 386
Not pastured	84, 186
Other pasture (not cropland and not woodland)	7, 792
Other land (farmsteads, roads, and wasteland)	6, 369

Number and type of farm

In 1959, there were 903 farms in the county. About 53 percent of the farms were miscellaneous and unclassified. The rest are listed by type and number as follows:

Type of farm:	*Number of farms*
Dairy	218
Field crop	5
Fruit	20
General	20
Livestock	31
Poultry	121
Vegetable	5

Farm tenure

In 1959, full owners operated 684 of the 903 farms in the county; part owners operated 203 farms; tenants operated 12; and managers operated 4. The average age of farm operators was 52.6 years. There were 188 operators 65 years of age or older.

Crops

The acreage of the principal crops and the number of bearing fruit trees are shown in table 16.

Hay has always been the leading crop in the county. Timothy, smooth bromegrass, alfalfa, red clover, ladino clover, and alsike clover are the main plants grown in mixtures for forage. Corn is grown mostly for silage. A very small amount is grown for grain by a few farmers. Oats is the main small grain and is used as a nurse crop for spring seedings of new hay and pasture. The oat crop

is generally pastured, but may be grown for grain, for hay, or for silage. Winter rye is grown as a cover crop. It is pastured in spring or later combined for seed.

Commercial apple orchards are located on hills where there is enough air movement to prevent frost damage. McIntosh, Red Delicious, Cortland, and Baldwin are the principal varieties grown. The orchards are in the townships of Concord, Webster, Salisbury, Hopkinton, Henniker, Andover, Canterbury, and Pittsfield. Most of the orchards are on Paxton soils.

Market vegetables, potatoes, strawberries, and other crops are grown on a limited acreage. Sweet corn is grown as a cash crop by some farmers and sold to a local canning factory. The soils on bottom lands are well adapted to vegetables.

TABLE 16.—*Acreage of principal crops and number of bearing fruit trees in stated years*

Crop	1954	1959
	Acres	*Acres*
Corn for all purposes	1, 500	1, 430
Harvested for grain	164	44
Cut for silage	1, 309	1, 379
Grazed or cut for fodder	27	7
Oats, harvested	160	50
All hay	27, 396	20, 732
Alfalfa	1, 324	1, 083
Clover and timothy, alone or mixed	16, 134	9, 888
Oats and other small grains cut for hay	321	435
Other hay	8, 872	8, 931
Silage from grass or hay crops	745	395
Irish potatoes	[1] 225	[1] 89
Sweet corn	320	302
Small fruits harvested:		
Strawberries	12	5
Raspberries	12	5
Blueberries, tame or wild	116	29
	Number	*Number*
Apple trees	28, 993	23, 190
Peach trees	733	153
Pear trees	704	448

[1] Does not include acreage for farms with less than 20 bushels harvested.

Industries and Population

Merrimack County is mainly industrial, and most of the inhabitants earn their living in industrial work. Electronics and printing are the leading industries. The textile, shoe, leather, fiberboard, and lumber industries are also important.

In 1960, the total population of the county was 67,785. Concord, the largest city in the county and the third largest in the State, had a population of 28,991. Franklin, the second largest city, had a population of 6,742. All other towns have less than 4,000 people.

Transportation

There is an extensive system of roads in the county. Two interstate highways serve the area: No. 93 extends north and south approximately through the center of the county, and No. 89 extends from No. 93 south of Concord in a northwestern direction toward Lebanon. In addition to the many State Routes, U.S. Highway Nos. 3, 4, and 202 are in the county. Most country roads are paved or are surfaced with gravel.

The Boston and Maine Railroad provides passenger and freight service. Passenger service is available with connections for Boston, Massachusetts, White River Junction, Vermont, and Laconia, New Hampshire. Interstate bus service provides passenger transportation to most places in the county.

Concord Municipal Airport has a hard-surfaced, 5,000-foot runway with facilities for scheduled airlines. Scheduled air service is available at Manchester, 17 miles south of Concord. Another landing strip is at Hooksett. Two golf courses have landing strips adjacent to them for the use of patrons.

Recreation

Merrimack County has many picturesque and scenic places. There are many quaint villages that have buildings dating from colonial times. Many farms that were not profitable are now rural residences or summer homes.

Ponds and lakes are scattered throughout the area; most towns have at least one. Hunting and fishing are popular sports and offer excellent recreation. Clear ponds, lakes, and swift-moving streams are in the wooded hills.

There are five State parks in the county that have excellent facilities for bathing, boating, camping, hiking, picnicking, skiing, and scenic drives.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Catena. A sequence, or "chain," of soils on a landscape, developed from one kind of parent material but having different characteristics because of differences in relief and drainage.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose. Noncoherent; soil will not hold together in a mass.

Friable. When moist, soil crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm. When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. When wet, soil is readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky. When wet, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard. When dry, soil is moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, soil breaks into powder or individual grains under very slight pressure.

Cemented. Hard and brittle; little affected by moistening.

Drainage, natural. Refers to the conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Imperfectly or somewhat poorly drained soils are wet for significant periods but not all the time, and in podzolic soils commonly have mottlings below 6 to 16 inches in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Drumlin. A long, oval hill of glacial drift.

Esker. A narrow, winding ridge or mound of stratified gravelly and sandy drift that was deposited by a subglacial stream.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Glacial outwash. Cross-bedded gravel, sand, and silt deposited by meltwater as it flowed from glacial ice.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.

Gravel. Rounded and subrounded rock fragments larger than very coarse sand and not more than 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons:

A horizon. The mineral horizon at the surface. It has an accumulation of organic matter, has been leached of soluble minerals and clay, or shows the effects of both.

B horizon. The horizon in which clay minerals or other materials have accumulated, that has developed a characteristic blocky or prismatic structure, or that shows the effects of both processes.

C horizon. The unconsolidated material immediately under the true soil. In chemical, physical, and mineral composition it is presumed to be similar to the material from which at least part of the overlying solum has developed.

D horizon. Any layer, or stratum, underlying the C horizon, or the B horizon if no C horizon is present. If this substratum is rock that presumably was the source of material in the C horizon, it is designated Dr.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Loam. A textural class of soils having a moderate amount of sand, silt, and clay. Loam soils contain 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *Fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Pan layer (fragipan). A dense and brittle layer that owes its hardness mainly to extreme density or compactness rather than to a high clay content or to cementation. Disturbed fragments are friable, but in place the material is so dense that roots cannot penetrate it and water moves through it very slowly because of small pores.

Permeability. The quality of a soil horizon that enables water and air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

pH value. A numerical means for designating relative acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from the adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. Structureless soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, usually about 5 to 8 inches in thickness. The plow layer.

Substratum. Any layer lying beneath the solum, or true soil; the C or D horizon.

Terrace escarpment. The sloping or steep, relatively even front of terraces.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. Presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Undifferentiated soil group (mapping unit). Two or more soils or land types that are mapped as one unit because their differences are not significant to the purpose of the survey or to soil management.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).

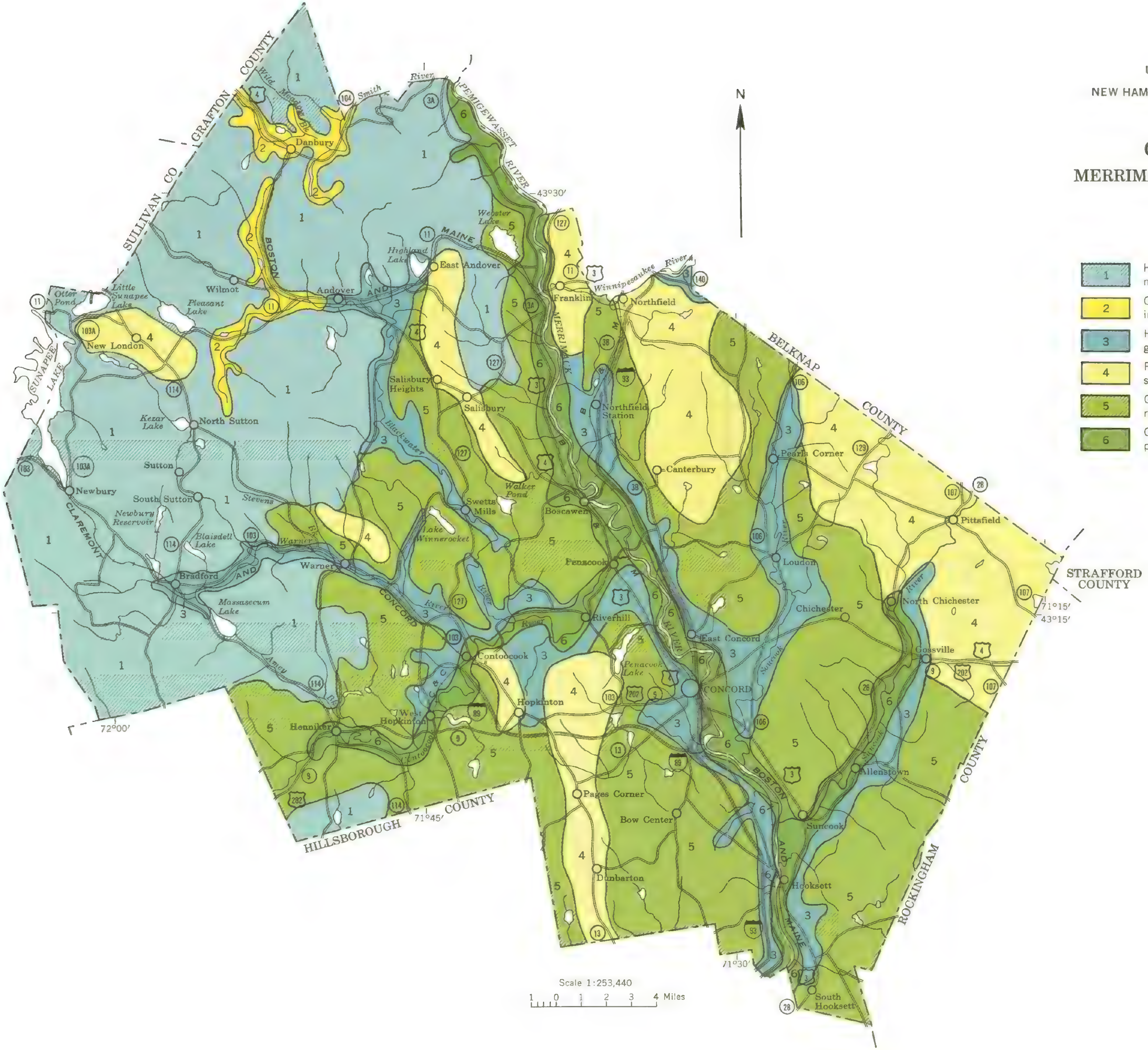
SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE
NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

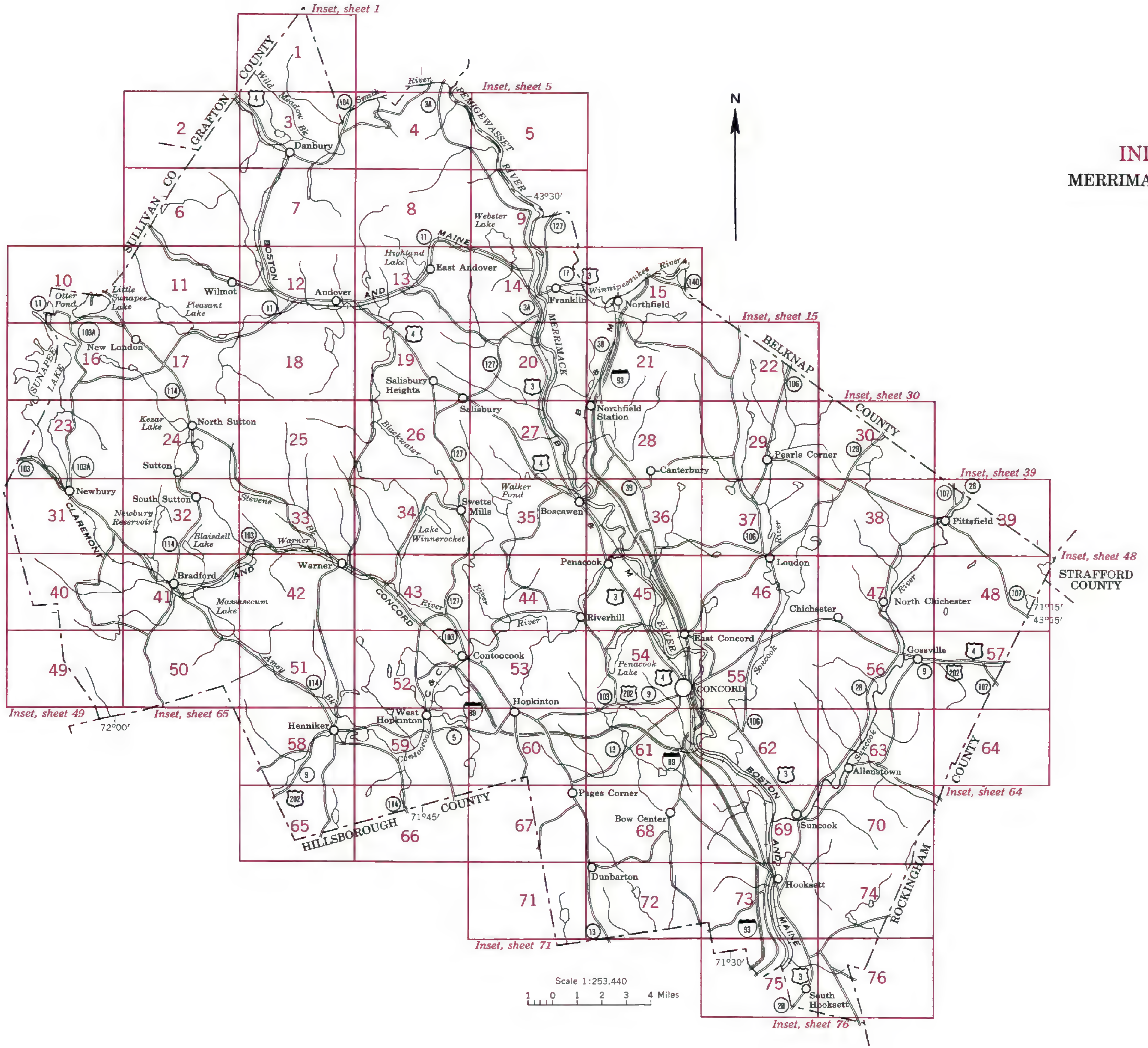
GENERAL SOIL MAP
MERRIMACK COUNTY, NEW HAMPSHIRE

SOIL ASSOCIATIONS

1	Hermon-Canaan-Colton association: Soils on hills and mountains
2	Colton-Rumney association: Soils on sand and gravel in narrow valleys and on narrow, wet flood plains
3	Hinckley-Windsor-Au Gres association: Sandy and gravelly soils of plains, mounds, ridges, and depressions
4	Paxton-Shapleigh-Woodbridge association: Soils on smooth low hills
5	Gloucester-Shapleigh-Whitman association: Soils on rolling uplands and in scattered swamps
6	Ondawa-Windsor-Agawam association: Soils on flood plains and stream terraces

March 1964





INDEX TO MAP SI

MERRIMACK COUNTY, NEV

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS

[See table 1, p. 17, for estimated productivity ratings of each unit, and table 9, p. 56, for approximate acreage and proportionate extent of the soils. See tables 5, 6, and 7, pp. 30, 32, and 42, for information on the engineering properties of the soils]

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
AcB	Acton fine sandy loam, 0 to 8 percent slopes	57	IIw-52	9	1	20
AdB	Acton very stony fine sandy loam, 0 to 8 percent slopes	57	VIs-72	14	1	20
AdC	Acton very stony fine sandy loam, 8 to 15 percent slopes	58	VIs-72	14	1	20
AfA	Agawam very fine sandy loam, 0 to 3 percent slopes	58	I-2	7	2	21
AfB	Agawam very fine sandy loam, 3 to 8 percent slopes	58	IIe-2	7	2	21
AgA	Au Gres fine sandy loam, 0 to 3 percent slopes	59	IIIw-23	12	3	21
AgB	Au Gres fine sandy loam, 3 to 8 percent slopes	59	IIIw-23	12	3	21
AuB	Au Gres loamy sand, 0 to 8 percent slopes	59	IIIw-23	12	3	21
BcB	Belgrade silt loam, 0 to 8 percent slopes	60	IIw-32	9	2	21
CaC	Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes	60	VIs-57	13	6	22
CaD	Canaan-Hermon very rocky sandy loams, 15 to 25 percent slopes	60	VIs-57	13	6	22
ChD	Canaan-Hermon extremely rocky sandy loams, 8 to 25 percent slopes	60	VIIs-58	15	8	23
ChE	Canaan-Hermon extremely rocky sandy loams, 25 to 60 percent slopes	60	VIIs-58	15	8	23
CoA	Colton loamy sand, 0 to 3 percent slopes	61	IIIs-26	12	5	22
CoB	Colton loamy sand, 3 to 8 percent slopes	61	IIIs-26	12	5	22
CoC	Colton loamy sand, 8 to 15 percent slopes	61	IVs-26	13	5	22
CtE	Colton gravelly loamy sand, 15 to 60 percent slopes	61	VIIs-27	14	5	22
DuB	Duane fine sandy loam, 0 to 8 percent slopes	62	IIw-22	8	2	21
GcB	Gloucester sandy loam, 3 to 8 percent slopes	62	IIs-55	10	4	22
GcC	Gloucester sandy loam, 8 to 15 percent slopes	62	IIIe-55	11	4	22
GcD	Gloucester sandy loam, 15 to 25 percent slopes	62	IVe-55	13	4	22
GrB	Gloucester very stony sandy loam, 3 to 8 percent slopes	62	VIs-7	13	4	22
GrC	Gloucester very stony sandy loam, 8 to 15 percent slopes	63	VIs-7	13	4	22
GrD	Gloucester very stony sandy loam, 15 to 25 percent slopes	63	VIs-7	13	4	22
GrE	Gloucester very stony sandy loam, 25 to 60 percent slopes	63	VIIs-7	14	4	22
GsD	Gloucester extremely stony sandy loam, 8 to 25 percent slopes	63	VIIs-58	15	4	22
GsE	Gloucester extremely stony sandy loam, 25 to 60 percent slopes	63	VIIs-58	15	4	22
Gv	Gravel pits	63	-------	--	--	--
HmB	Hermon sandy loam, 3 to 8 percent slopes	64	IIs-55	10	4	22
HmC	Hermon sandy loam, 8 to 15 percent slopes	64	IIIe-55	11	4	22
HmD	Hermon sandy loam, 15 to 25 percent slopes	64	IVe-55	13	4	22
HnB	Hermon very stony sandy loam, 3 to 8 percent slopes	64	VIs-7	13	4	22
HnC	Hermon very stony sandy loam, 8 to 15 percent slopes	64	VIs-7	13	4	22
HnD	Hermon very stony sandy loam, 15 to 25 percent slopes	64	VIs-7	13	4	22
HoD	Hermon extremely stony sandy loam, 8 to 25 percent slopes	64	VIIs-58	15	4	22
HoE	Hermon extremely stony sandy loam, 25 to 60 percent slopes	64	VIIs-58	15	4	22
HrE	Hinckley gravelly loamy sand, 15 to 60 percent slopes	65	VIIs-27	14	5	22
HsA	Hinckley loamy sand, 0 to 3 percent slopes	65	IIIs-26	12	5	22
HsB	Hinckley loamy sand, 3 to 8 percent slopes	65	IIIs-26	12	5	22
HsC	Hinckley loamy sand, 8 to 15 percent slopes	65	IVs-26	13	5	22
Lm	Limerick silt loam, high bottom	65	IIIw-13	11	7	23
Ma	Made land	65	-------	--	--	--
Mh	Marsh	65	VIIIw-89	15	--	--
MmA	Merrimac sandy loam, 0 to 3 percent slopes	66	IIs-25	9	5	22
MmB	Merrimac sandy loam, 3 to 8 percent slopes	66	IIs-25	9	5	22
MmC	Merrimac sandy loam, 8 to 15 percent slopes	66	IIIe-25	11	5	22
Mn	Mixed alluvial land	66	VIIw-14	14	--	--
Mp	Muck and Peat	66	VIIw-14	14	9	23
NnA	Ninigret very fine sandy loam, 0 to 3 percent slopes	67	IIw-22	8	2	21
Of	Ondawa fine sandy loam	68	IIw-10	8	2	21
Oh	Ondawa fine sandy loam, high bottom	68	I-1	7	2	21
PaB	Paxton loam, 0 to 8 percent slopes	69	IIe-6	7	2	21
PaC	Paxton loam, 8 to 15 percent slopes	69	IIIe-6	10	2	21
PaD	Paxton loam, 15 to 25 percent slopes	69	IVe-6	13	2	21
PnB	Paxton very stony loam, 3 to 8 percent slopes	69	VIs-7	13	2	21
PnC	Paxton very stony loam, 8 to 15 percent slopes	69	VIs-7	13	2	21
PnD	Paxton very stony loam, 15 to 25 percent slopes	69	VIs-7	13	2	21
PnE	Paxton very stony loam, 25 to 60 percent slopes	69	VIIs-7	14	2	21
Po	Podunk fine sandy loam	70	IIw-12	8	2	21
RbA	Ridgebury loam, 0 to 3 percent slopes	70	IIIw-63	12	3	21
RbB	Ridgebury loam, 3 to 8 percent slopes	70	IIIw-63	12	3	21
RdA	Ridgebury and Whitman very stony loams, 0 to 3 percent slopes	70	VIIs-74	15	3	21
RdB	Ridgebury and Whitman very stony loams, 3 to 8 percent slopes	70	VIIs-74	15	3	21
Rh	Riverwash	70	VIIIs-90	15	--	--
Ro	Rock outcrop	71	VIIIs-90	15	--	--
Ru	Rumney fine sandy loam	71	IIIw-13	11	7	23
Sa	Saco silt loam	71	VIIw-14	14	9	23
Sc	Scarboro fine sandy loam	72	Vw-24	13	7	23
SgB	Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes	72	IIe-56	8	6	22
SgC	Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes	72	IIIe-56	11	6	22
ShC	Shapleigh-Gloucester very rocky sandy loams, 3 to 15 percent slopes	73	VIs-57	13	6	22
ShD	Shapleigh-Gloucester very rocky sandy loams, 15 to 25 percent slopes	73	VIs-57	13	6	22
SoD	Shapleigh-Gloucester extremely rocky sandy loams, 8 to 25 percent slopes	73	VIIs-58	15	8	23
SoE	Shapleigh-Gloucester extremely rocky sandy loams, 25 to 60 percent slopes	73	VIIs-58	15	8	23
SuA	Sudbury fine sandy loam, 0 to 3 percent slopes	73	IIw-22	8	2	21
SuB	Sudbury fine sandy loam, 3 to 8 percent slopes	73	IIw-22	8	2	21
Sy	Suncook loamy sand	74	IIIs-16	12	5	22
WdA	Windsor loamy sand, 0 to 3 percent slopes	75	IIIs-26	12	5	22
WdB	Windsor loamy sand, 3 to 8 percent slopes	75	IIIs-26	12	5	22
WdC	Windsor loamy sand, 8 to 15 percent slopes	75	IVs-26	13	5	22
WdE	Windsor loamy sand, 15 to 60 percent slopes	75	VIIs-26	14	5	22
WoB	Woodbridge loam, 0 to 8 percent slopes	76	IIw-62	9	1	20
WoC	Woodbridge loam, 8 to 15 percent slopes	76	IIIe-62	11	1	20
WvB	Woodbridge very stony loam, 0 to 8 percent slopes	76	VIs-72	14	1	20
WvC	Woodbridge very stony loam, 8 to 15 percent slopes	76	VIs-72	14	1	20

729-915 O - 65 (Face p. 94)

SOIL LEGEND

The first capital letter is the initial letter of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Some symbols without a slope letter are for nearly level soils, such as Saco silt loam, but some are for soils or land types that have a considerable range of slope.

SYMBOL	NAME
AcB	Acton fine sandy loam, 0 to 8 percent slopes
AdB	Acton very stony fine sandy loam, 0 to 8 percent slopes
AdC	Acton very stony fine sandy loam, 8 to 15 percent slopes
AfA	Agawam very fine sandy loam, 0 to 3 percent slopes
AfB	Agawam very fine sandy loam, 3 to 8 percent slopes
AgA	Au Gres fine sandy loam, 0 to 3 percent slopes
AgB	Au Gres fine sandy loam, 3 to 8 percent slopes
AuB	Au Gres loamy sand, 0 to 8 percent slopes
BcB	Belgrade silt loam, 0 to 8 percent slopes
CaC	Canaan-Hermon very rocky sandy loams, 3 to 15 percent slopes
CaD	Canaan-Hermon very rocky sandy loams, 15 to 25 percent slopes
ChD	Canaan-Hermon extremely rocky sandy oams, 8 to 25 percent slopes
ChE	Canaan-Hermon extremely rocky sandy loams, 25 to 60 percent slopes
CoA	Colton loamy sand, 0 to 3 percent slopes
CoB	Colton loamy sand, 3 to 8 percent slopes
CoC	Colton loamy sand, 8 to 15 percent slopes
CtE	Colton gravelly loamy sand, 15 to 60 percent slopes
DuB	Duane fine sandy loam, 0 to 8 percent slopes
GcB	Gloucester sandy loam, 3 to 8 percent slopes
GcC	Gloucester sandy loam, 8 to 15 percent slopes
GcD	Gloucester sandy loam, 15 to 25 percent slopes
GrB	Gloucester very stony sandy loam, 3 to 8 percent slopes
GrC	Gloucester very stony sandy loam, 8 to 15 percent slopes
GrD	Gloucester very stony sandy loam, 15 to 25 percent slopes
GrE	Gloucester very stony sandy loam, 25 to 60 percent slopes
GsD	Gloucester extremely stony sandy loam, 8 to 25 percent slopes
GsE	Gloucester extremely stony sandy loam, 25 to 60 percent slopes
Gv	Gravel pits
HmB	Hermon sandy loam, 3 to 8 percent slopes
HmC	Hermon sandy loam, 8 to 15 percent slopes
HmD	Hermon sandy loam, 15 to 25 percent slopes
HnB	Hermon very stony sandy loam, 3 to 8 percent slopes
HnC	Hermon very stony sandy loam, 8 to 15 percent slopes
HnD	Hermon very stony sandy loam, 15 to 25 percent slopes
HoD	Hermon extremely stony sandy loam, 8 to 25 percent slopes
HoE	Hermon extremely stony sandy loam, 25 to 60 percent slopes
HrE	Hinckley gravelly loamy sand, 15 to 60 percent slopes
HsA	Hinckley loamy sand, 0 to 3 percent slopes
HsB	Hinckley loamy sand, 3 to 8 percent slopes
HsC	Hinckley loamy sand, 8 to 15 percent slopes
Lm	Limerick silt loam, high bottom
Ma	Made land
Mh	Marsh
MmA	Merrimac sandy loam, 0 to 3 percent slopes
MmB	Merrimac sandy loam, 3 to 8 percent slopes
MmC	Merrimac sandy loam, 8 to 15 percent slopes
Mn	Mixed alluvial land
Mp	Muck and Peat
NnA	Ninigret very fine sandy loam, 0 to 3 percent slopes
Of	Ondawa fine sandy loam
Oh	Ondawa fine sandy loam, high bottom
PaB	Paxton loam, 0 to 8 percent slopes
PaC	Paxton loam, 8 to 15 percent slopes
PaD	Paxton loam, 15 to 25 percent slopes
PnB	Paxton very stony loam, 3 to 8 percent slopes
PnC	Paxton very stony loam, 8 to 15 percent slopes
PnD	Paxton very stony loam, 15 to 25 percent slopes
PnE	Paxton very stony loam, 25 to 60 percent slopes
Po	Podunk fine sandy loam
RbA	Ridgebury loam, 0 to 3 percent slopes
RbB	Ridgebury loam, 3 to 8 percent slopes
RdA	Ridgebury and Whitman very stony loams, 0 to 3 percent slopes
RdB	Ridgebury and Whitman very stony loams, 3 to 8 percent slopes
Rh	Riverwash
Ro	Rock outcrop
Ru	Rumney fine sandy loam
Sa	Saco silt loam
Sc	Scarboro fine sandy loam
SgB	Shapleigh-Gloucester sandy loams, 3 to 8 percent slopes
SgC	Shapleigh-Gloucester sandy loams, 8 to 15 percent slopes
ShC	Shapleigh-Gloucester very rocky sandy loams, 3 to 15 percent slopes
ShD	Shapleigh-Gloucester very rocky sandy loams, 15 to 25 percent slopes
SoD	Shapleigh Gloucester extremely rocky sandy loams, 8 to 25 percent slopes
SoE	Shapleigh-Gloucester extremely rocky sandy loams, 25 to 60 percent slopes
SuA	Sudbury fine sandy loam, 0 to 3 percent slopes
SuB	Sudbury fine sandy loam, 3 to 8 percent slopes
Sy	Suncook loamy sand
WdA	Windsor loamy sand, 0 to 3 percent slopes
WdB	Windsor loamy sand, 3 to 8 percent slopes
WdC	Windsor loamy sand, 8 to 15 percent slopes
WdE	Windsor loamy sand, 15 to 60 percent slopes
WoB	Woodbridge loam, 0 to 8 percent slopes
WoC	Woodbridge loam, 8 to 15 percent slopes
WvB	Woodbridge very stony loam, 0 to 8 percent slopes
WvC	Woodbridge very stony loam, 8 to 15 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Summer cottage

Mines and Quarries

Mine dump

Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Sawmill

Forest fire or lookout station

BOUNDARIES

- National or state
- County
- Reservation
- Township, civil

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches — CANAL, DITCH

Lakes and ponds
- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions — Large, Small
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies
- Wind erosion, moderate
- Wind erosion, severe

Soil map constructed 1963 by Cartographic Division, Soil Conservation Service, USDA, from 1953 aerial photographs. Controlled mosaic based on New Hampshire plane coordinate system, transverse Mercator projection. 1927 North American datum.

(Joins inset)

(Joins upper center)

N

(2) | (Joins sheet 3)

Scale 1: 20 000

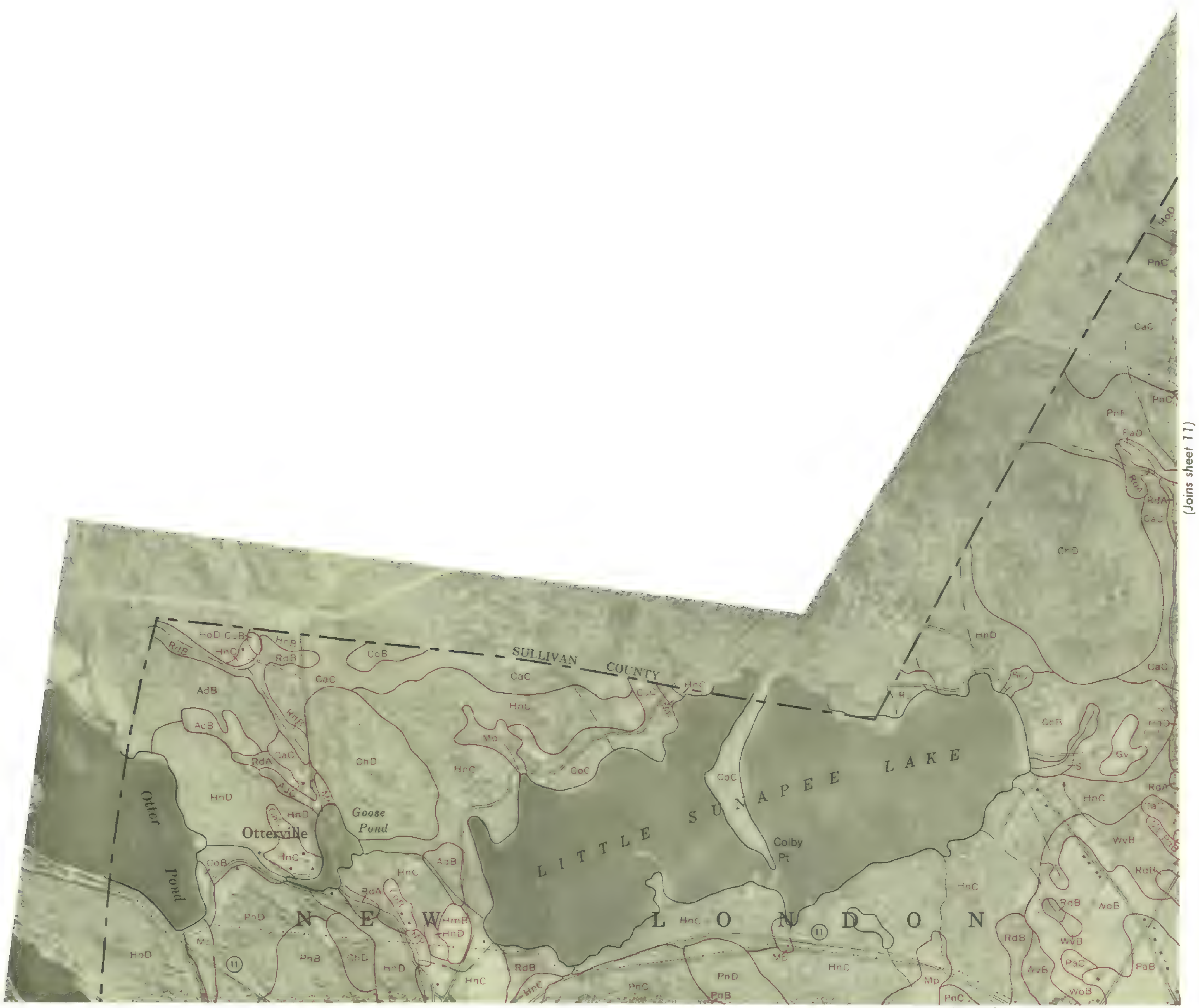
0 ½ 1 Mile

0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

(10)

N



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 16)

11

(Joins sheet 6)

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 17)

N

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

12

(Joins sheet 7)

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 18)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 14

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

16

N

(Joins sheet 10)

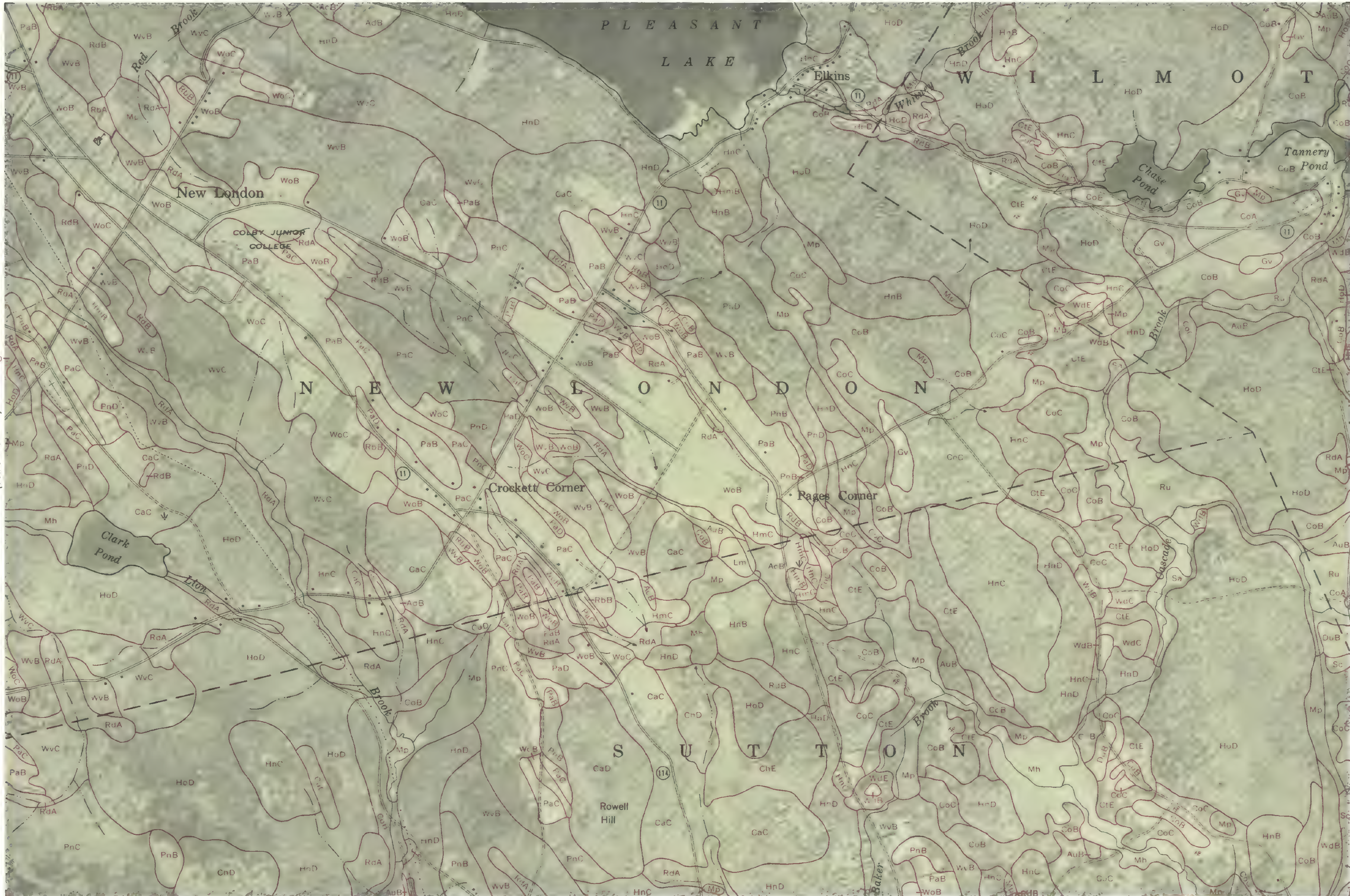
(Joins sheet 17)

(Joins sheet 23)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 11)

17



(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 24)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station


(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
N
Wilmot Flat
Morey Hill
Morey Pond
Bradley Lake
Beech Hill
Wilder Pond
Mountain Brook
Hameshop Bk
Bradley Brook
W I L M O T
A N D O V E R
S A L I S B U R Y
W A R N E R
SUTTON
KEARSARGE STATE RESERVATION
ROLLINS STATE PARKS
KEARSARGE STATE PARKS
MOUNT KEARSARGE
PARK BOUNDARY
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

(Joins sheet 13)

19

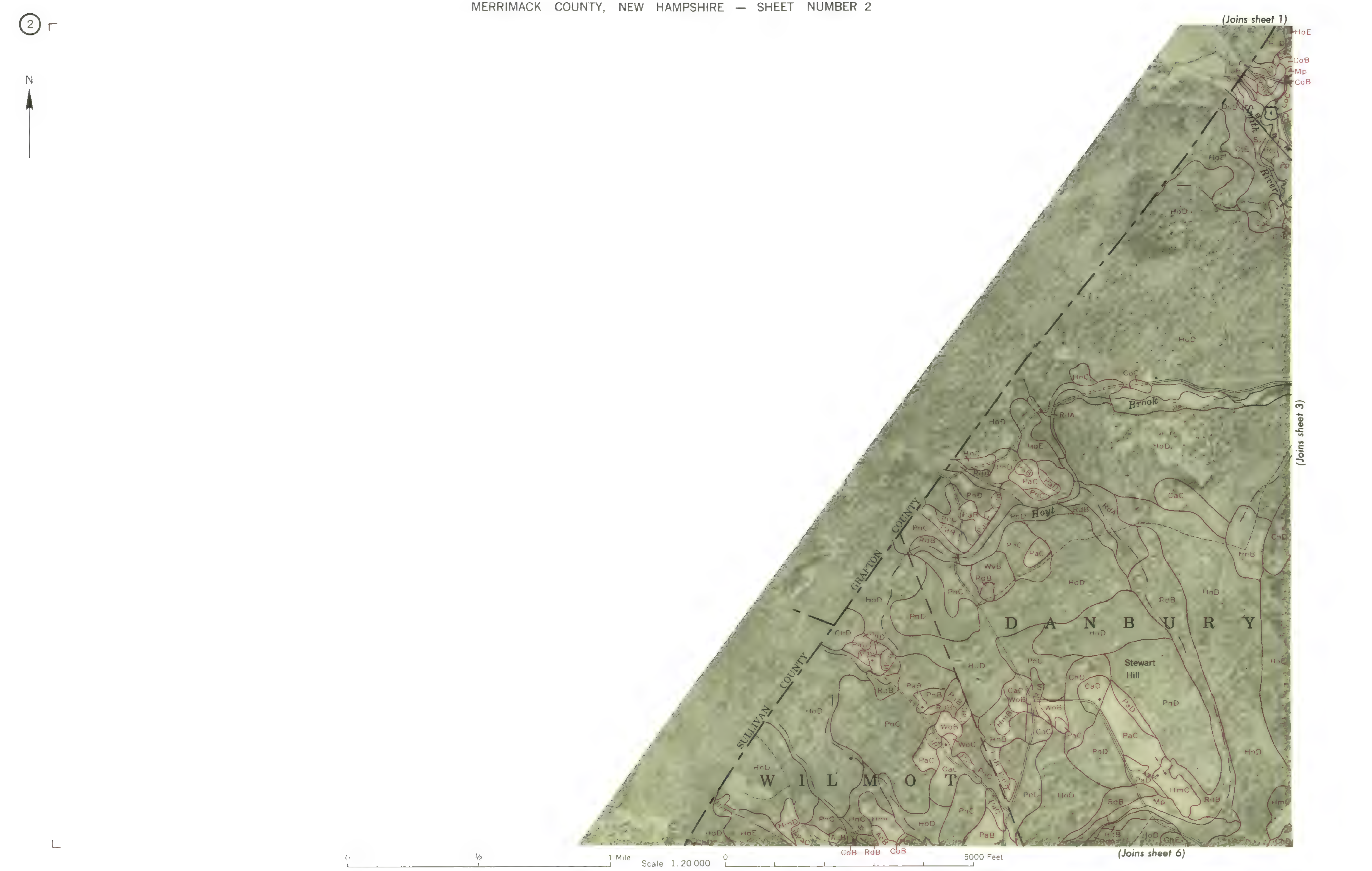
This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 26)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


2
N
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 6)
GRAFTON COUNTY
SULLIVAN COUNTY
D A N B U R Y
W I L M O T
Stewart Hill
Smith River
Brook
Hoyt
HoE
CoB
Mp
HoD
HnD
PnD
PnC
PaC
PaB
RdB
RdA
CaC
CaD
ChD
WoB
WoC
HmC
HnB
HnC
CoB RdB CoB
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 20

(Joins sheet 15)

21

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 28)

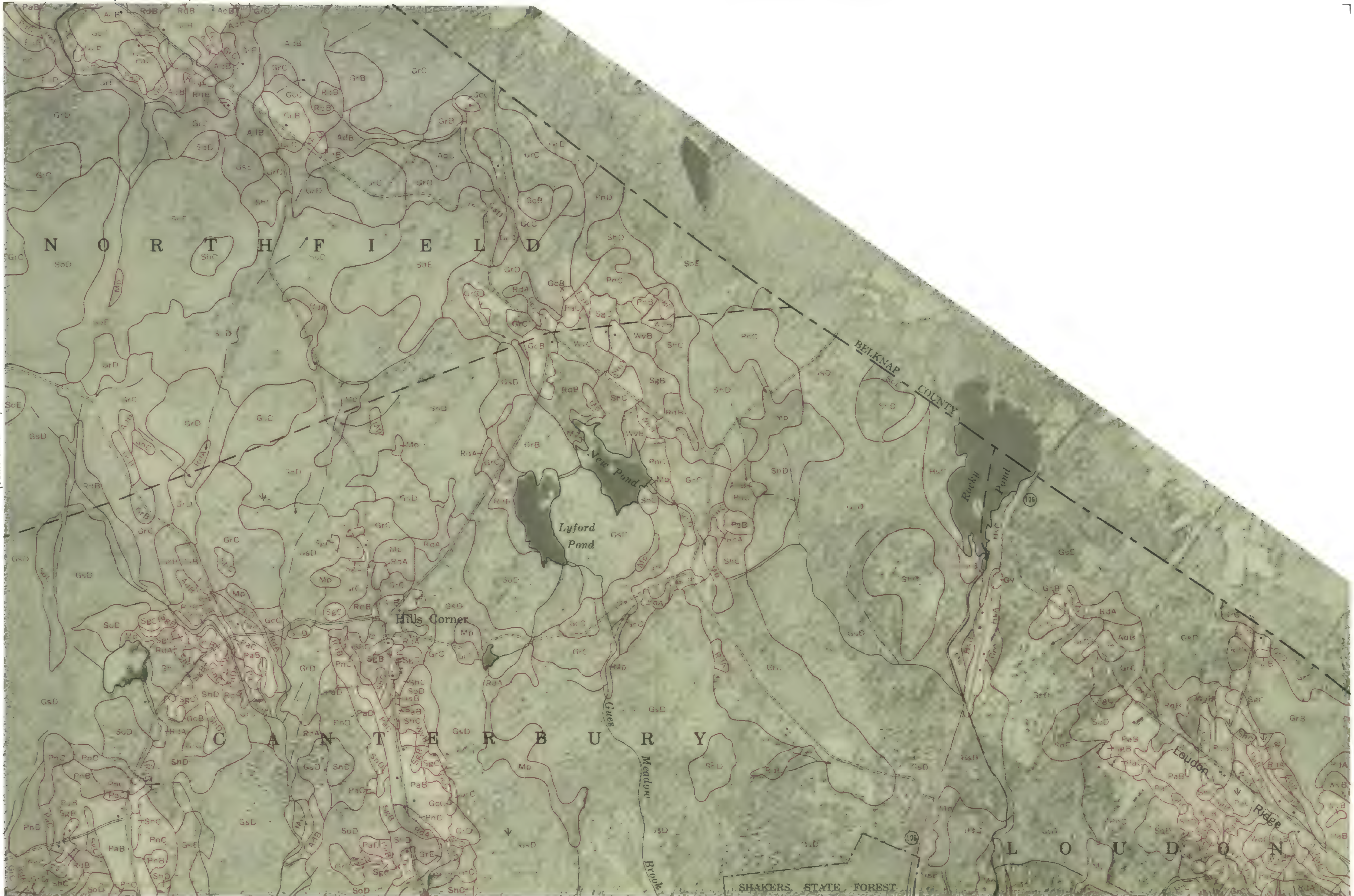
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

22

(Joins sheet 15)

(Joins sheet 21)



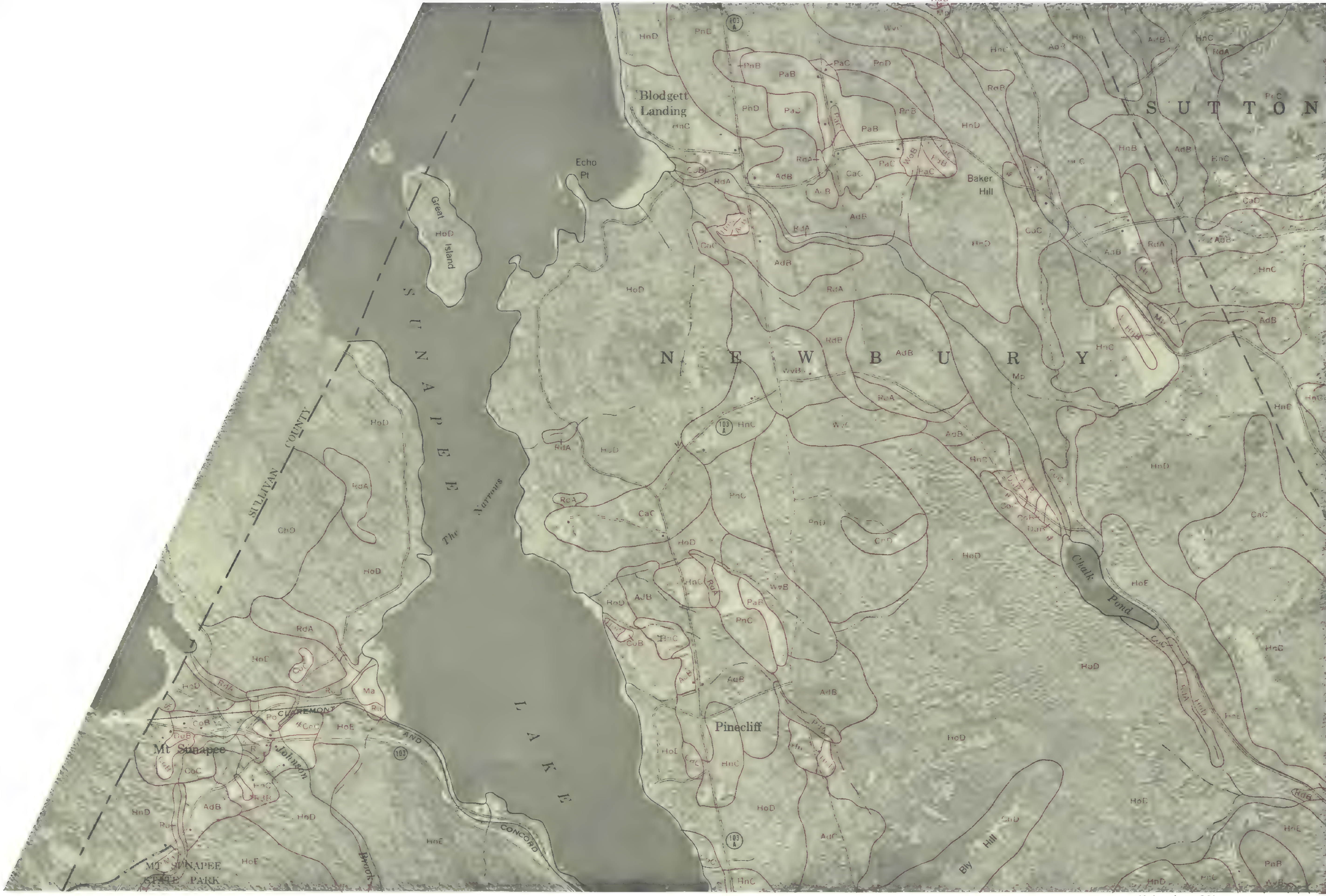
(Joins inset, sheet 30)

(Joins sheet 29)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 16)

23



(Joins sheet 24)

(Joins sheet 31)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.


24
(Joins sheet 17)
N
Kings Hill
Lion
Brook
Kezar Lake
North Sutton
Baker Brook
Porter Hill
WADLEIGH STATE PARK
(Joins sheet 23)
(Joins sheet 25)
S U T T O N
Crate
Fellows Hill
Gile Pond
SHADOW HILL STATE FOREST
Shingle Mill Corner
Kings Brook
Wadleigh Hill
The Pinnacle
Pigeon Hill
Sutton
Thistle Brook
Stevens Brook
NEWBURY
(Joins sheet 32)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

(Joins sheet 18)

25

(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 33)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

26

(Joins sheet 19)

N

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 34)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 20)

27

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 35)

Scale 1: 20 000

0 ½ 1 Mile

0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

(Joins sheet 21)

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 36)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 3

(Joins sheet 1)

3

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 7)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

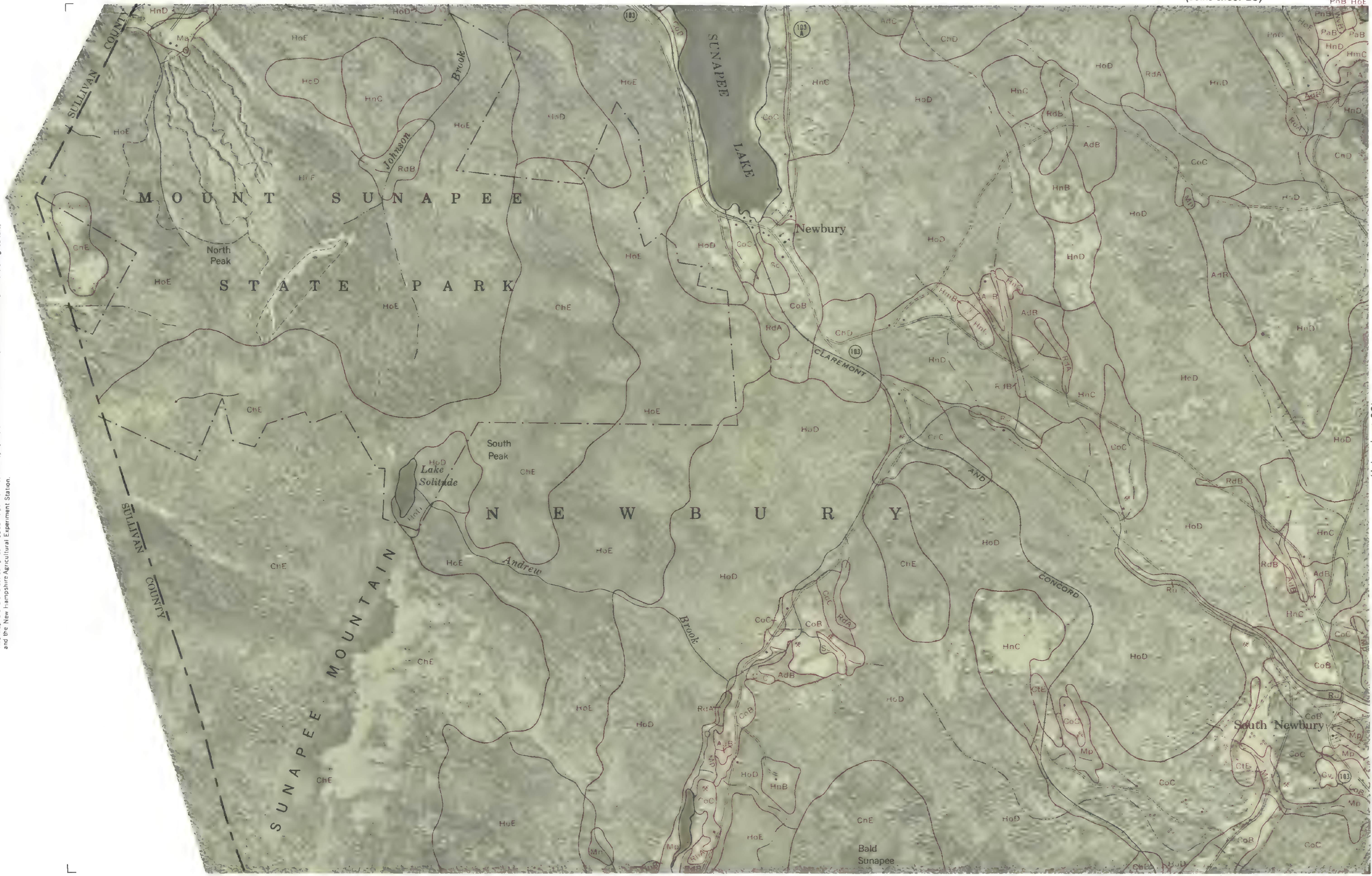
This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

30

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 23)

31



(Joins sheet 32)

(Joins sheet 40)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

32

(Joins sheet 24)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 41)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

33

(Joins sheet 25)

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 42)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the New Hampshire Agricultural Experiment Station

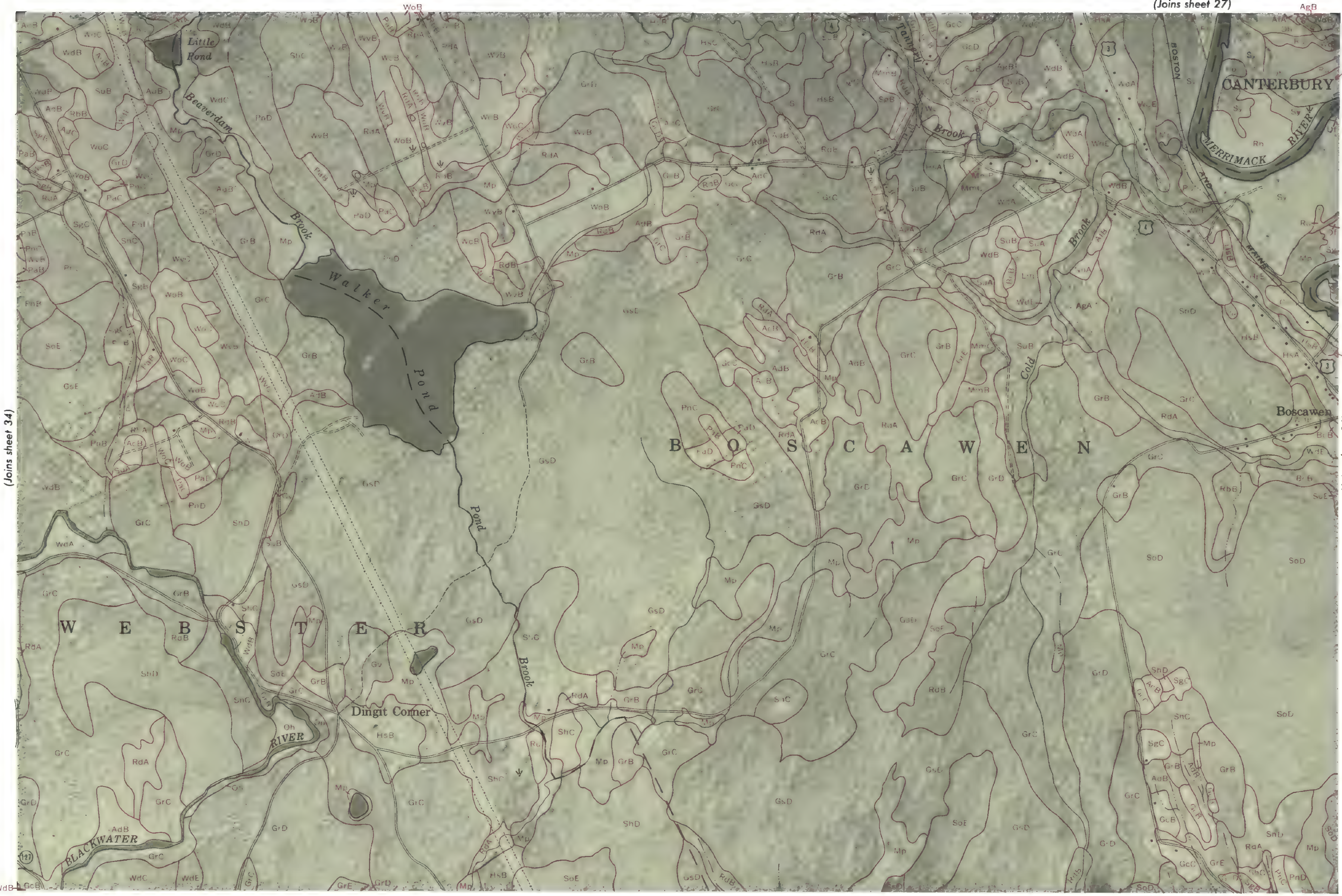
MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 34

(Joins sheet 27)

35

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

(Joins sheet 34)



(Joins sheet 36)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 44)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 29)

37

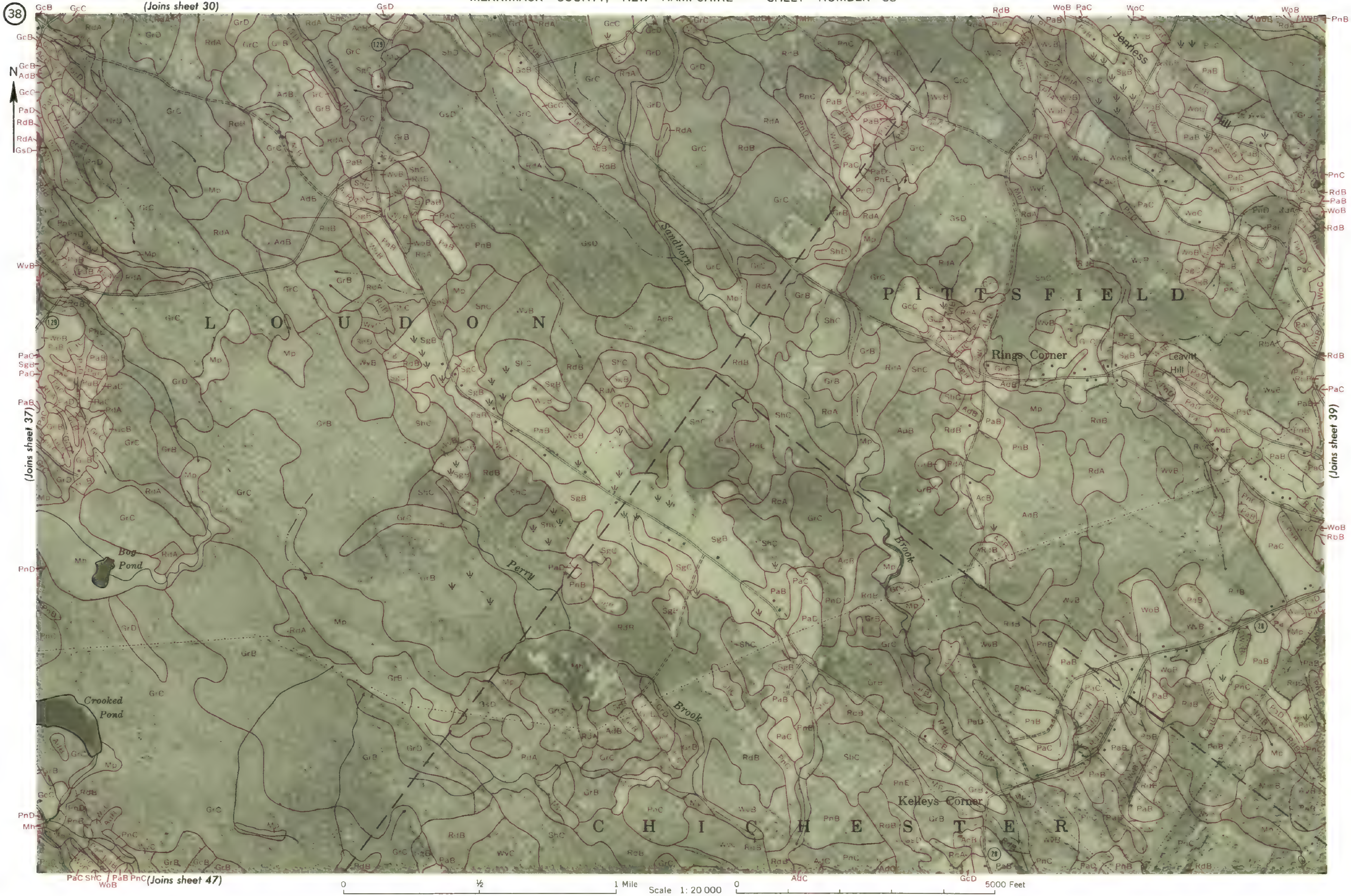
(Joins sheet 36)

(Joins sheet 38)

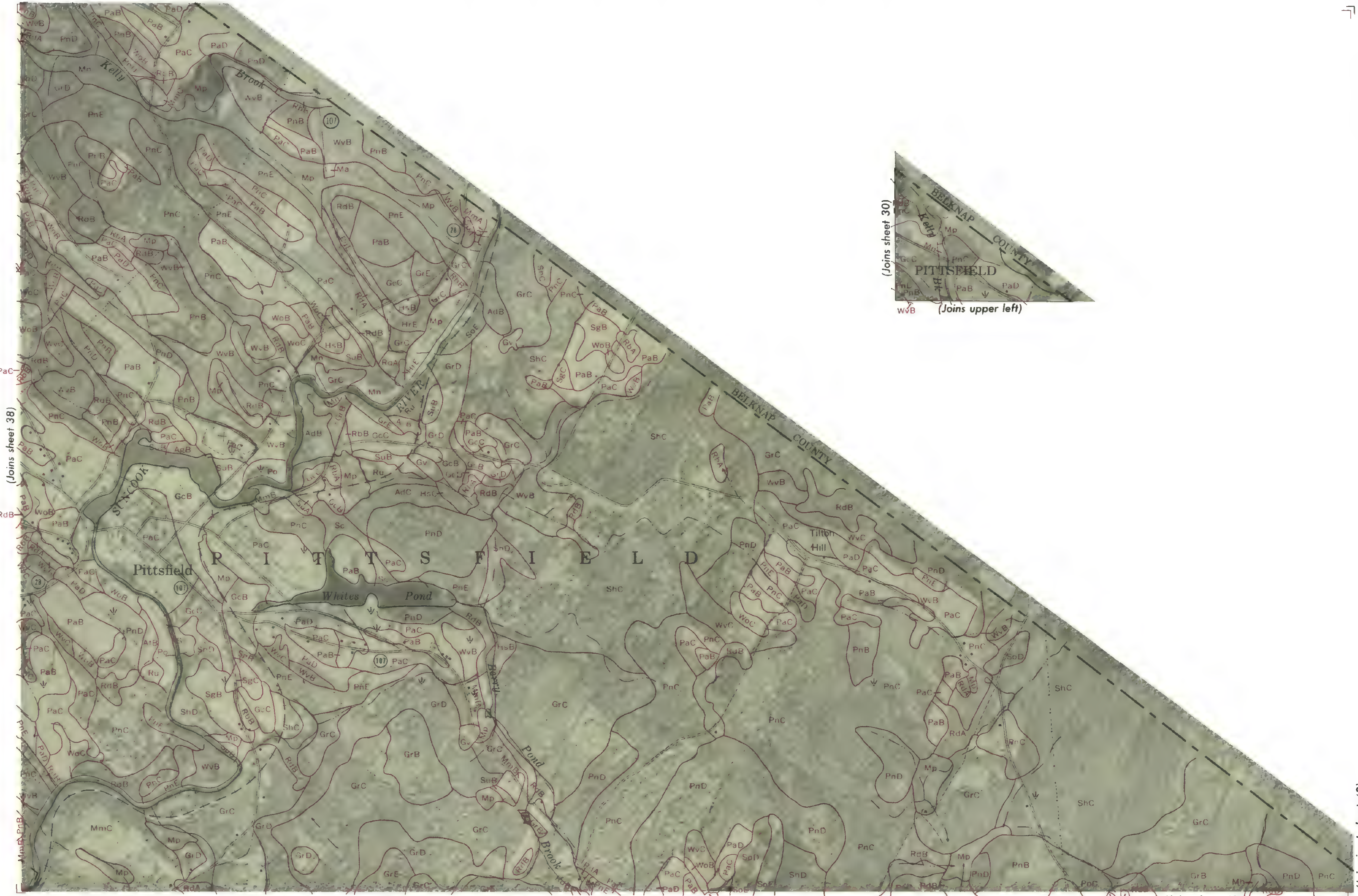
(Joins sheet 46)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.


38
(Joins sheet 30)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 47)
N
L O U D O N
P I T T S F I E L D
C H I C H E S T E R
Rings Corner
Kelleys Corner
Leavitt Hill
Jenness Hill
Sandborn
Perry
Brook
Brook
Bog Pond
Crooked Pond
129
28
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

(Joins inset)



N

(Joins sheet 48)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

(Joins inset, sheet 5)

N

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 8)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet


40
N
(Joins sheet 31)
Bald Sunapee
SUNAPEE MTN
N E W B U R Y
CLAREMONT AND CONCORD
Gillingham Pond
SULLIVAN COUNTY
Box Corner
West Branch
FAIR GROUNDS
(Joins sheet 41)
B R A D F O R D
Hoyt
(Joins sheet 49)
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

42


(Joins sheet 33)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 51)
N
WARNER RIVER
CLAREMONT AND CONCORD
New Market
W A R N E R
MINK HILLS
HARRIMAN CHANDLER STATE FOREST
Stewarts Peak
Cunningham Pond
Slaughter Brook
Silver Brook
Bartlett Brook
WALDRON HILL
Warner
CARROLL ST FOR
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

(Joins sheet 34)

43

(Joins sheet 42)

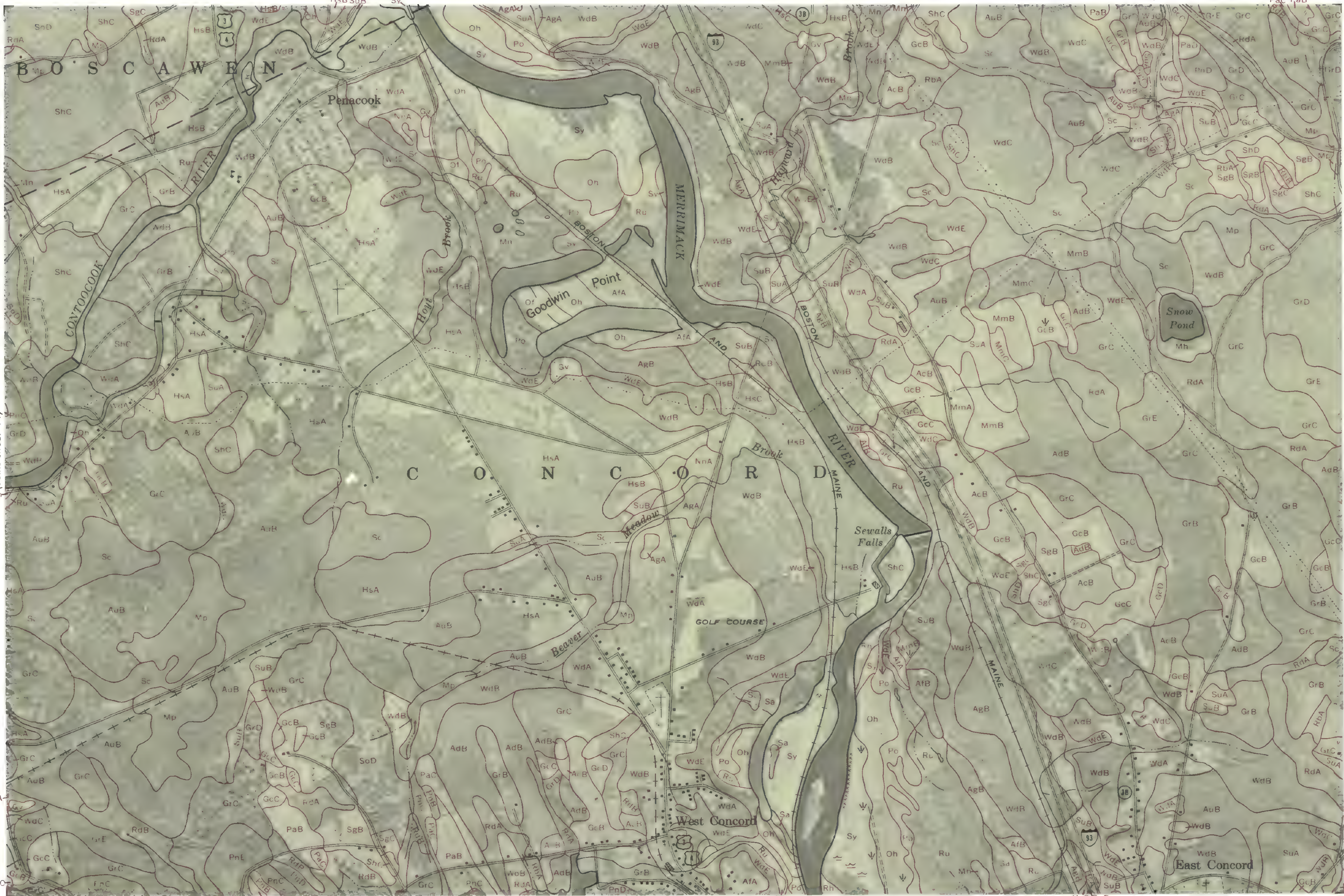
(Joins sheet 44)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 52)

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station


44
(Joins sheet 35)
N
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 53)
Snyders Mill
Gerrish Corner
W E B S T E R
B O S C A W E N
C O N C O R D
H O P K I N T O N
Dagody Hill
Little Pond
Horse Hill
Mast Yard
Riverhill
ALLEN STATE FOREST
MAST YARD STATE FOREST
BLACKWATER RIVER
CONTOOCOOK RIVER
Little Pond Brook
Meadow Brook
Deer Meadow Brook
Scale 1:20 000
0
½
1 Mile
0
5000 Feet



This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 46

(Joins sheet 37)

(Joins sheet 55)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 38)

(Joins sheet 46)

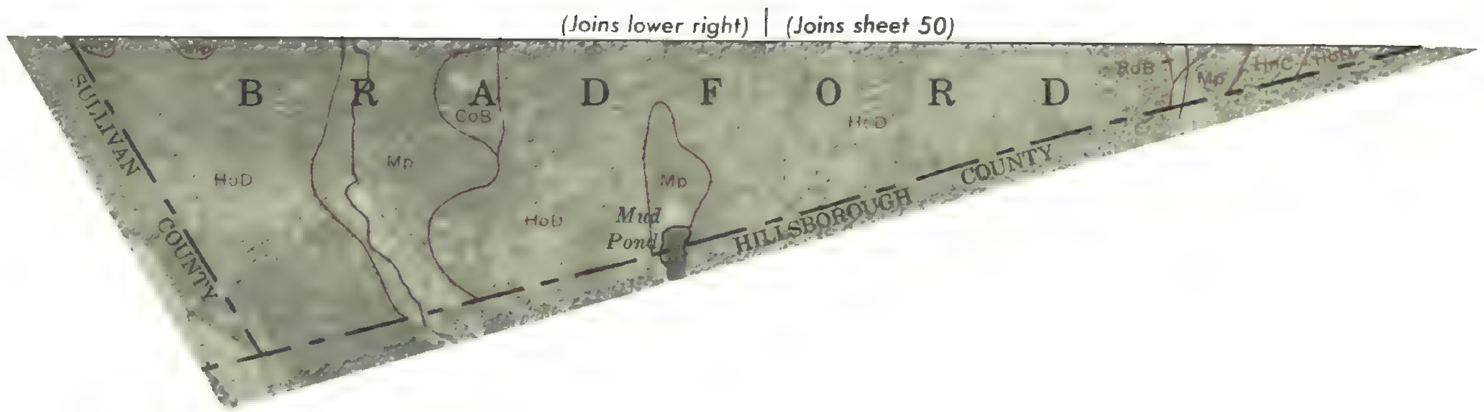
(Joins sheet 48)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 56)

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station


48
(Joins sheet 39)
(Joins sheet 47)
(Joins sheet 57)
(Joins inset)
N
P I T T S F I E L D
E P S O M
Catamount
Mountain
Berry Pond
Wild Goose Pond
Eaton Pond
Blake Pond
Jenness Pond
Odiorne Pond
Chestnut Pond
Shinglemill Bk
Flat Meadow Brook
Lockes Hill
Epsom Mountain
STRAFFORD CO
ROCKINGHAM COUNTY
(Joins upper right)
(Joins sh. 39)
BELKNAP CO
PITTSFIELD
STRAFFORD COUNTY
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

N

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

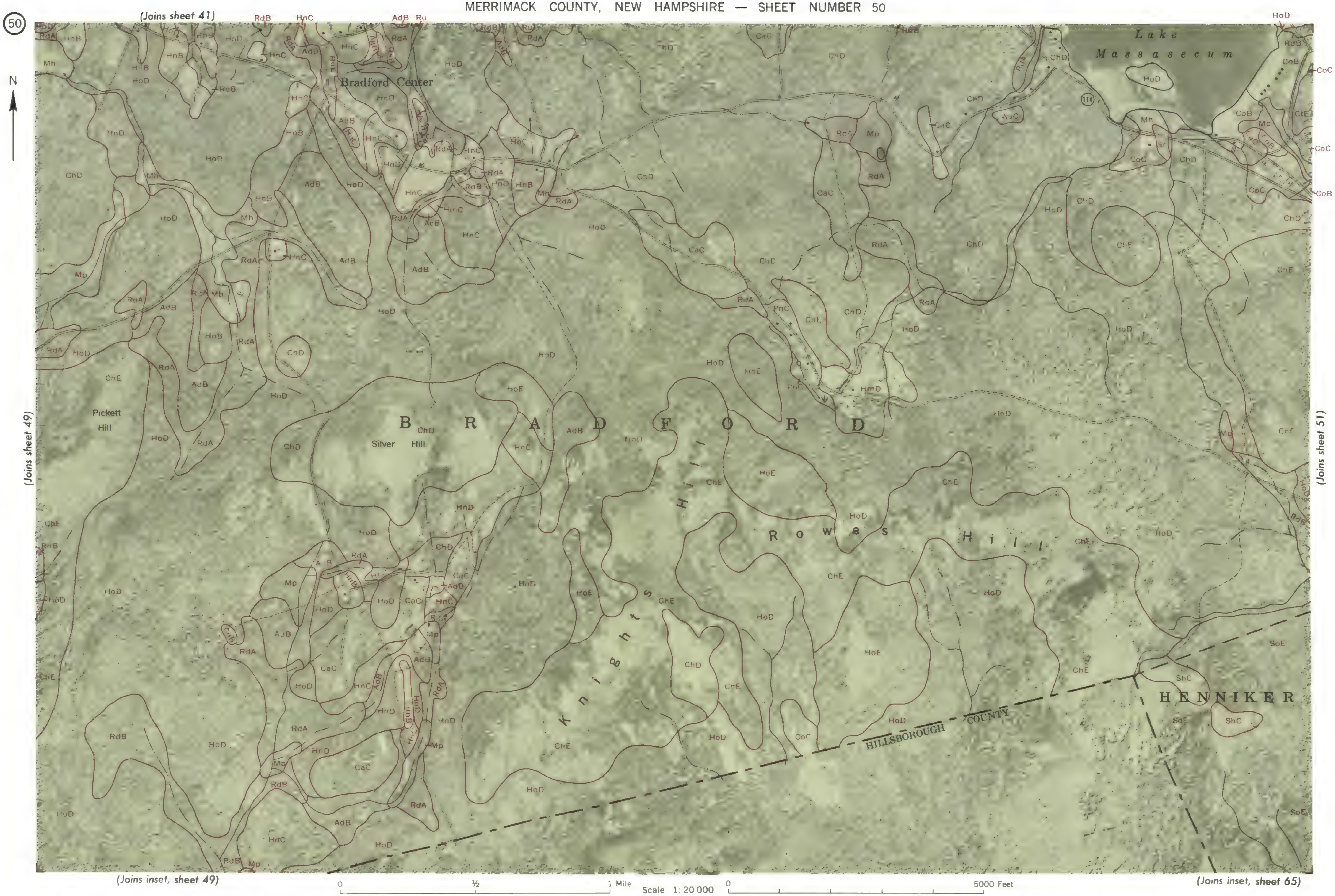
(Joins sheet 4)

(Joins sheet 9)

(Joins sheet 4)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 50



(Joins sheet 42)

51

(Joins sheet 50)

(Joins sheet 52)

(Joins sheet 58)

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

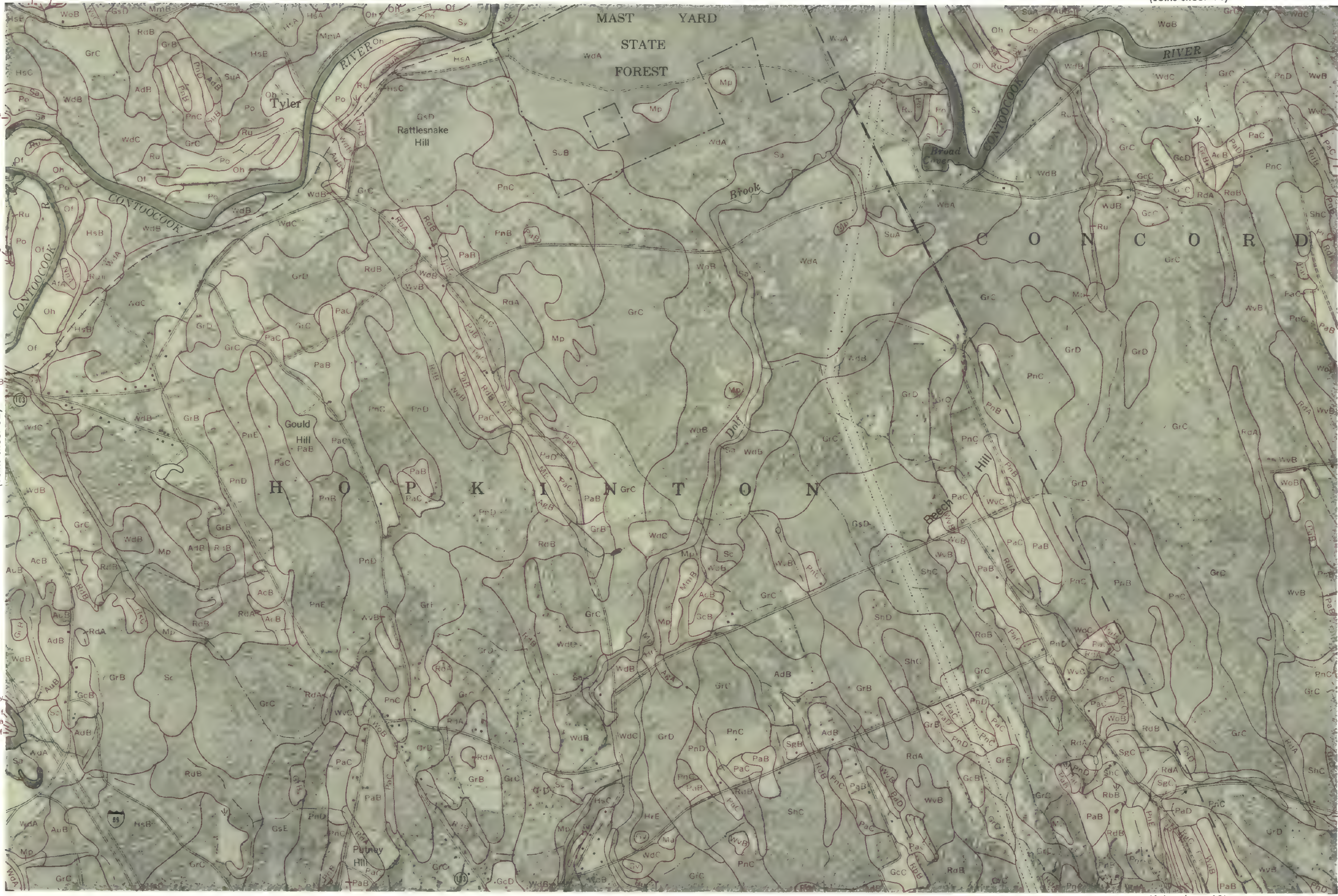
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 52

(Joins sheet 44)

53

(Joins sheet 52)



(Joins sheet 54)

(Joins sheet 60)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.


54
(Joins sheet 45)
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 61)
N
PENACOOK LAKE
Rattlesnake Hill
GRANITE
QUARRIES
STATE PRISON
BLOSSOM HILL CEMETERY
Parsonage Hill
Pine Hill
Jerry Hill
Little Pond
Woods Brook
WALKER STATE FOREST
C O N C O R D
CONCORD
(county seat)
East Concord
Rum Hill
MERRIMACK RIVER
Horse Shoe Pond
Bowen Brook
Mill Brook
Rattlesnake Brook
BOSTON AND MAINE
Scale 1:20 000
0
½
1 Mile
5000 Feet

(Joins sheet 46)

(Joins sheet 54)

(Joins sheet 56)

(Joins sheet 62)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 56

(Joins sheet 47)

(Joins sheet 55)

(Joins sheet 57)

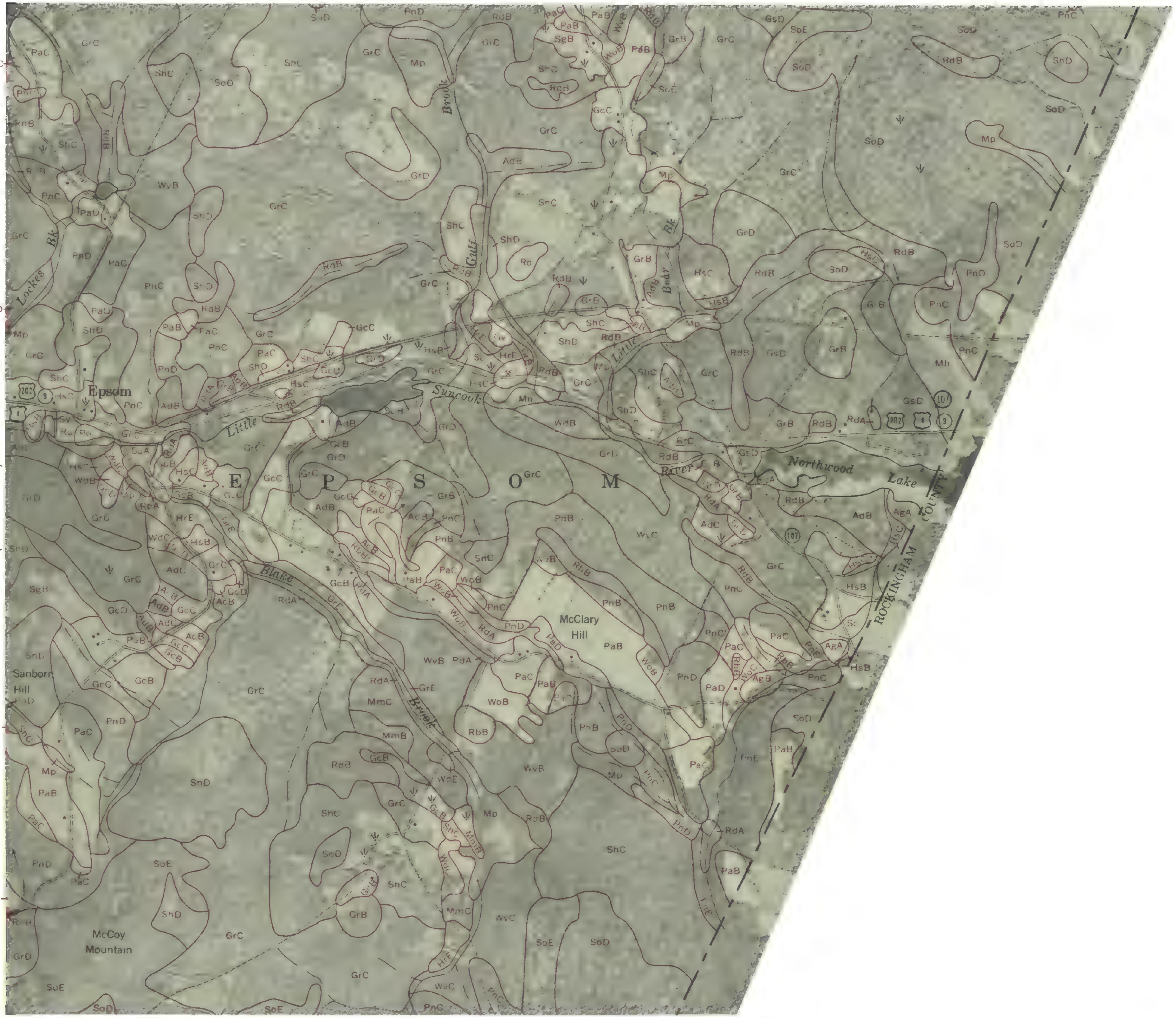
(Joins sheet 63)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

57

(Joins sheet 48)

(Joins sheet 56)



(Joins sheet 64)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

58

(Joins sheet 51)

N

(Joins inset, sheet 65)

(Joins sheet 59)

(Joins sheet 65)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 52)

59

(Joins sheet 58)

(Joins sheet 60)

(Joins sheet 66)

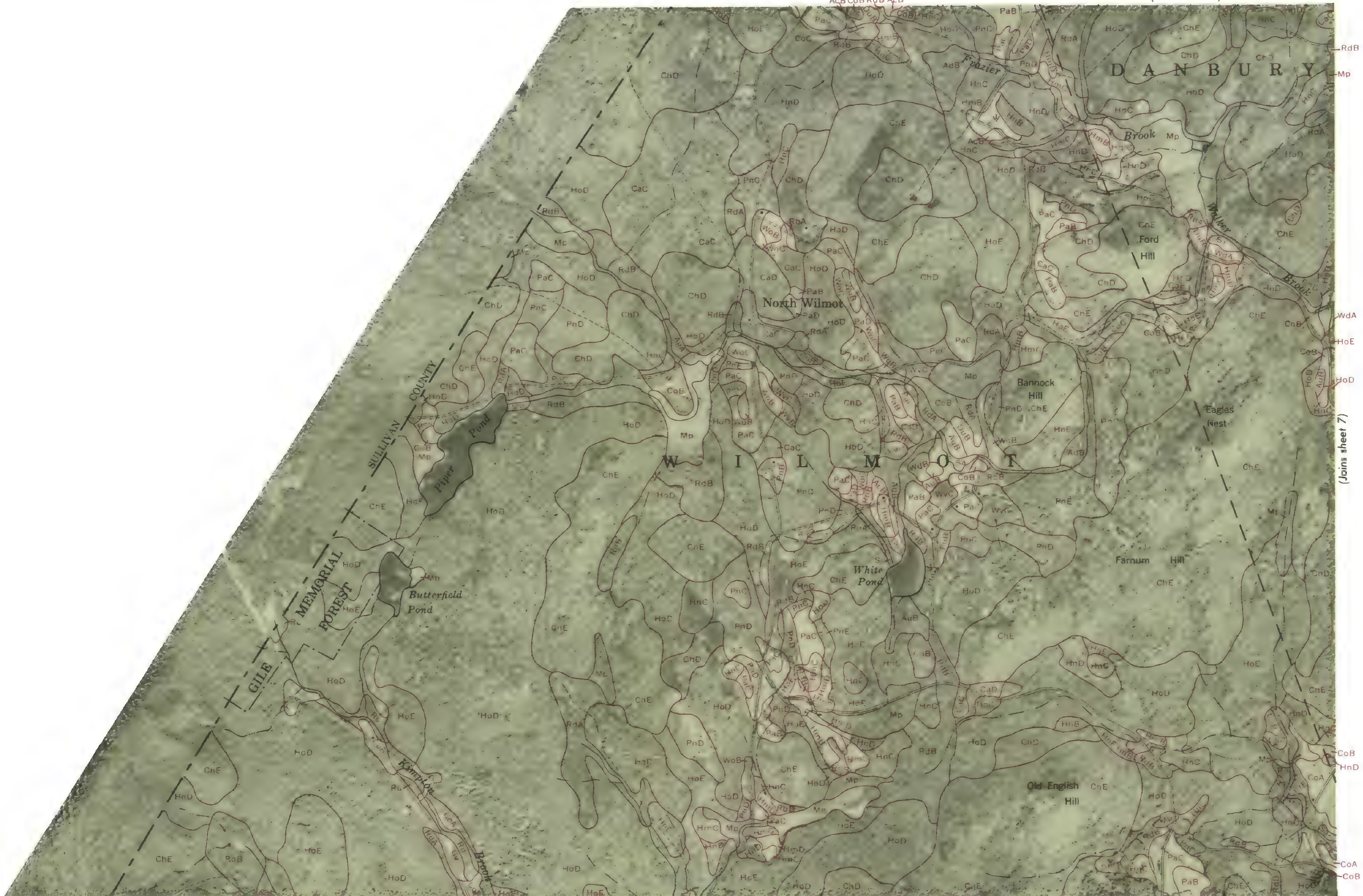
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

6

N

(Joins sheet 2)



(Joins sheet 7)

(Joins sheet 11)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 53)

(Joins sheet 59)

(Joins sheet 61)

(Joins sheet 67)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 54)

61

(Joins sheet 60)

(Joins sheet 62)

(Joins sheet 68)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

(62)

(Joins sheet 55)

(Joins sheet 61)

(Joins sheet 63)

(Joins sheet 69)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

63

(Joins sheet 56)

(Joins sheet 62)

(Joins sheet 64)

(Joins sheet 70)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

64

(Joins sheet 57)

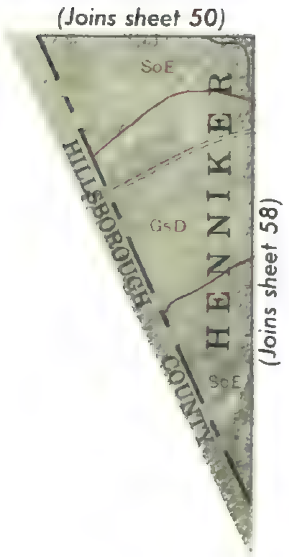
(Joins sheet 63)

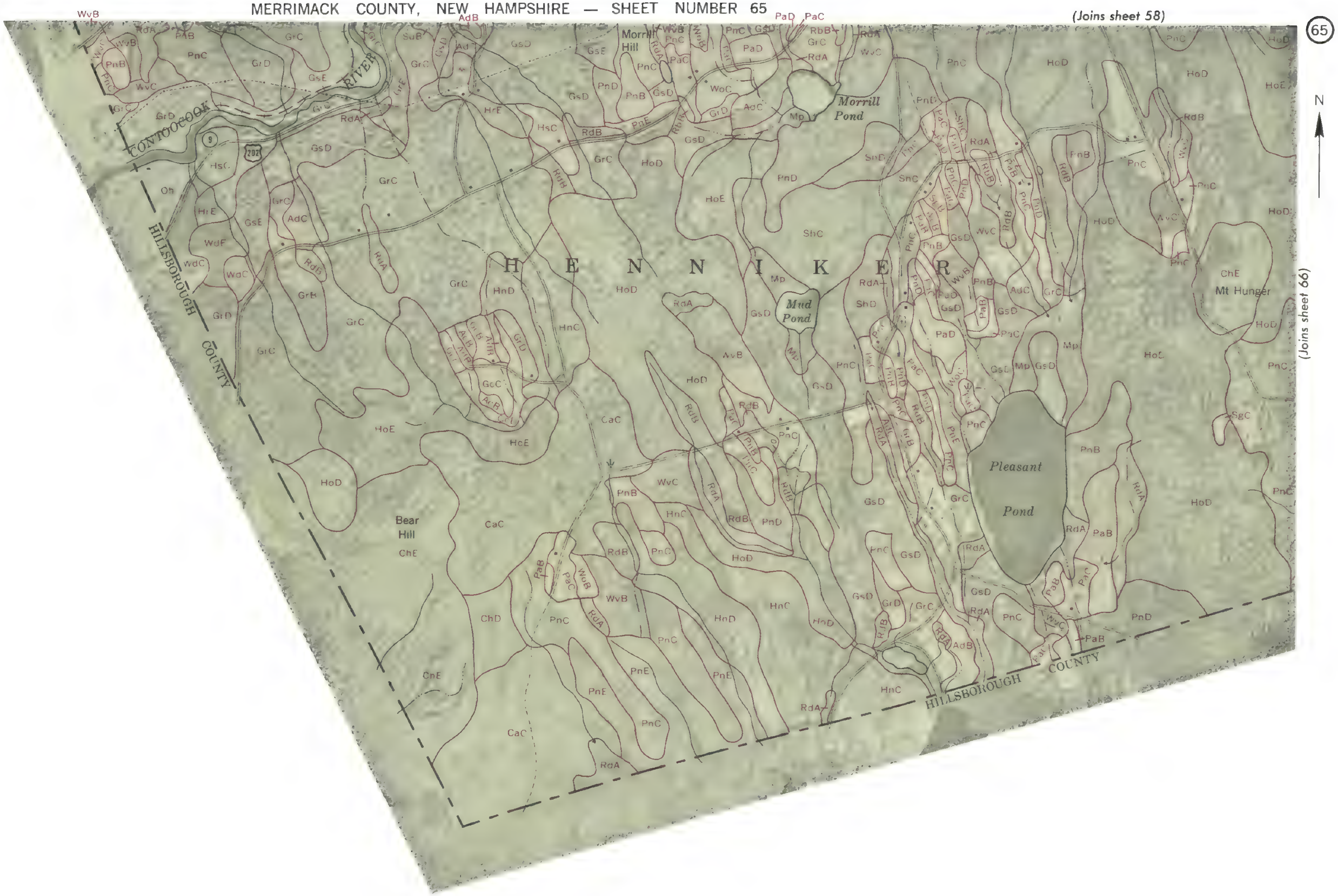
(Joins inset)

(Joins lower left)

(Joins sheet 70)

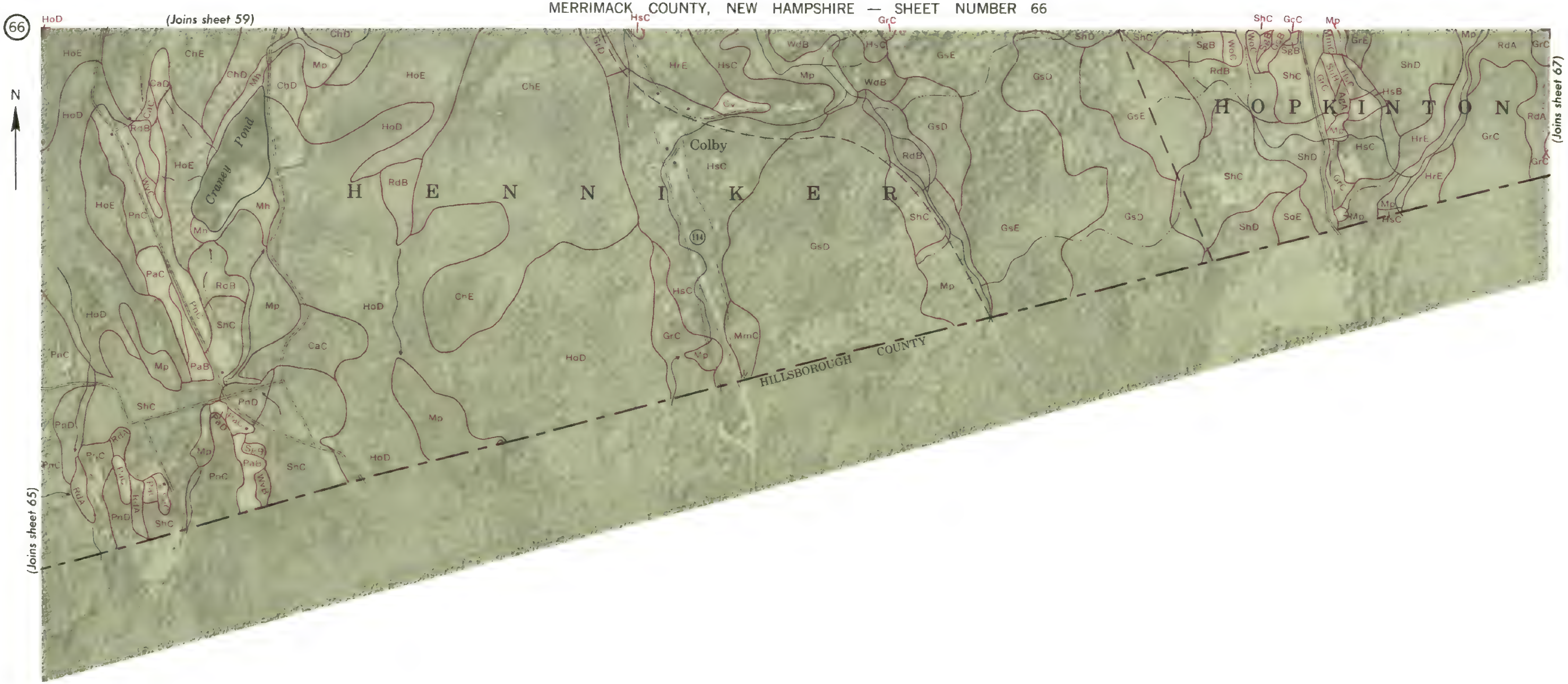
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



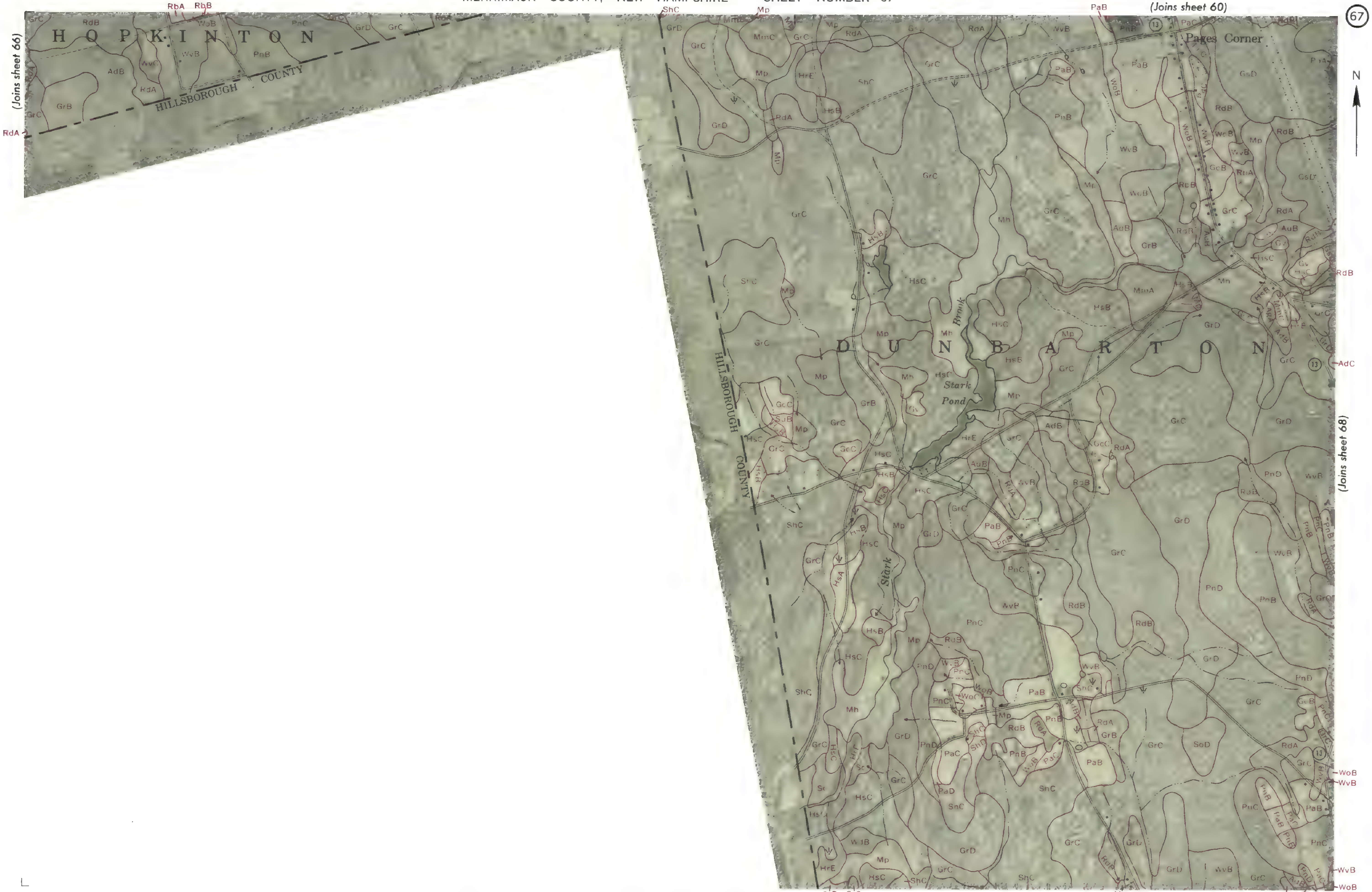


This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the New Hampshire Agricultural Experiment Station.

(Joins sheet 61)

(Joins sheet 67)

(Joins sheet 69)

(Joins sheet 72)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 62)

69

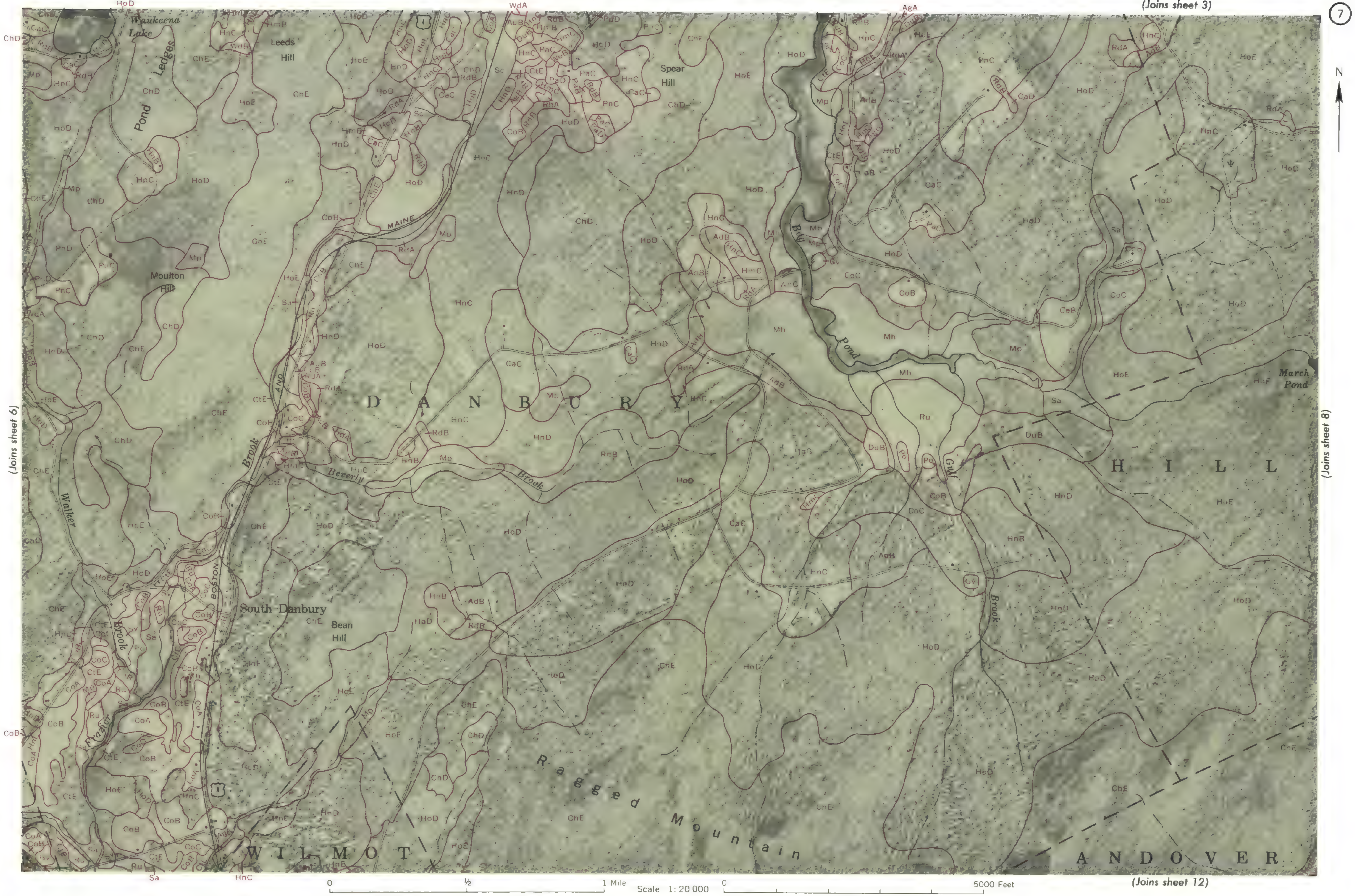
(Joins sheet 68)

(Joins sheet 70)

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

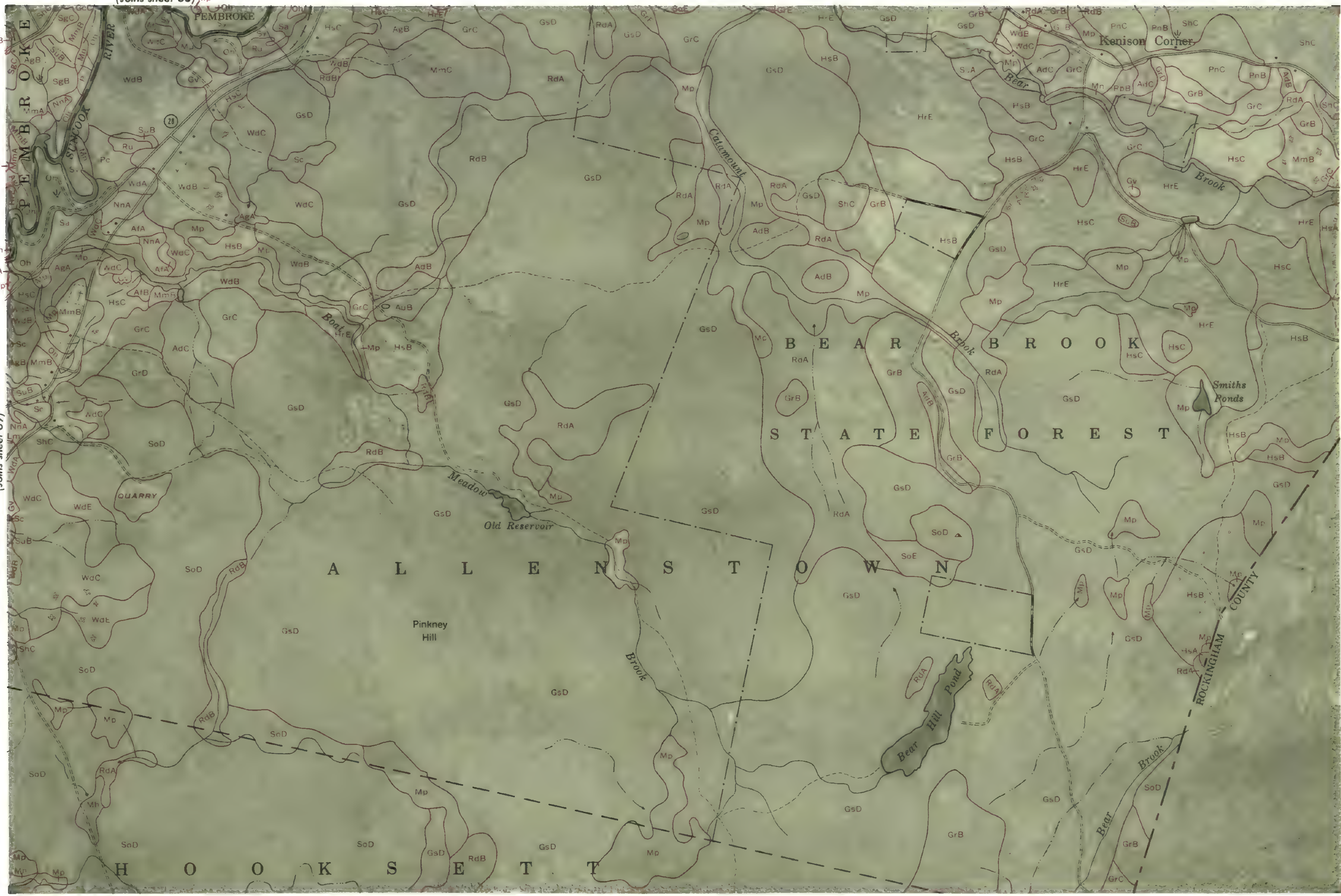
(Joins sheet 73)



This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

70

(Joins sheet 63)

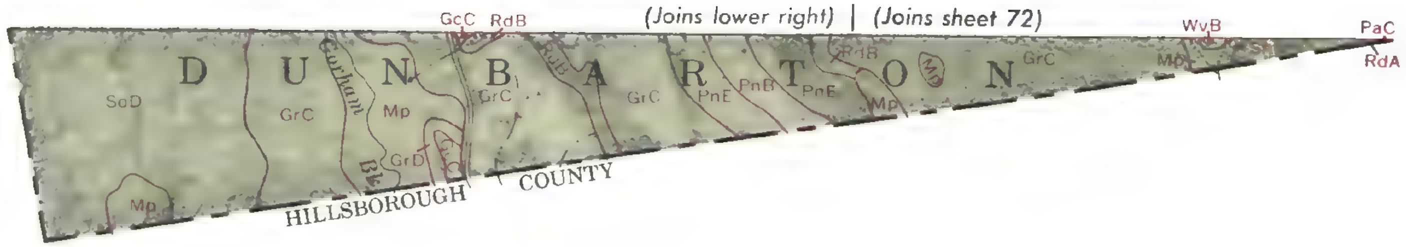


(Joins sheet 69)

(Joins inset, sheet 64)

(Joins sheet 74)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

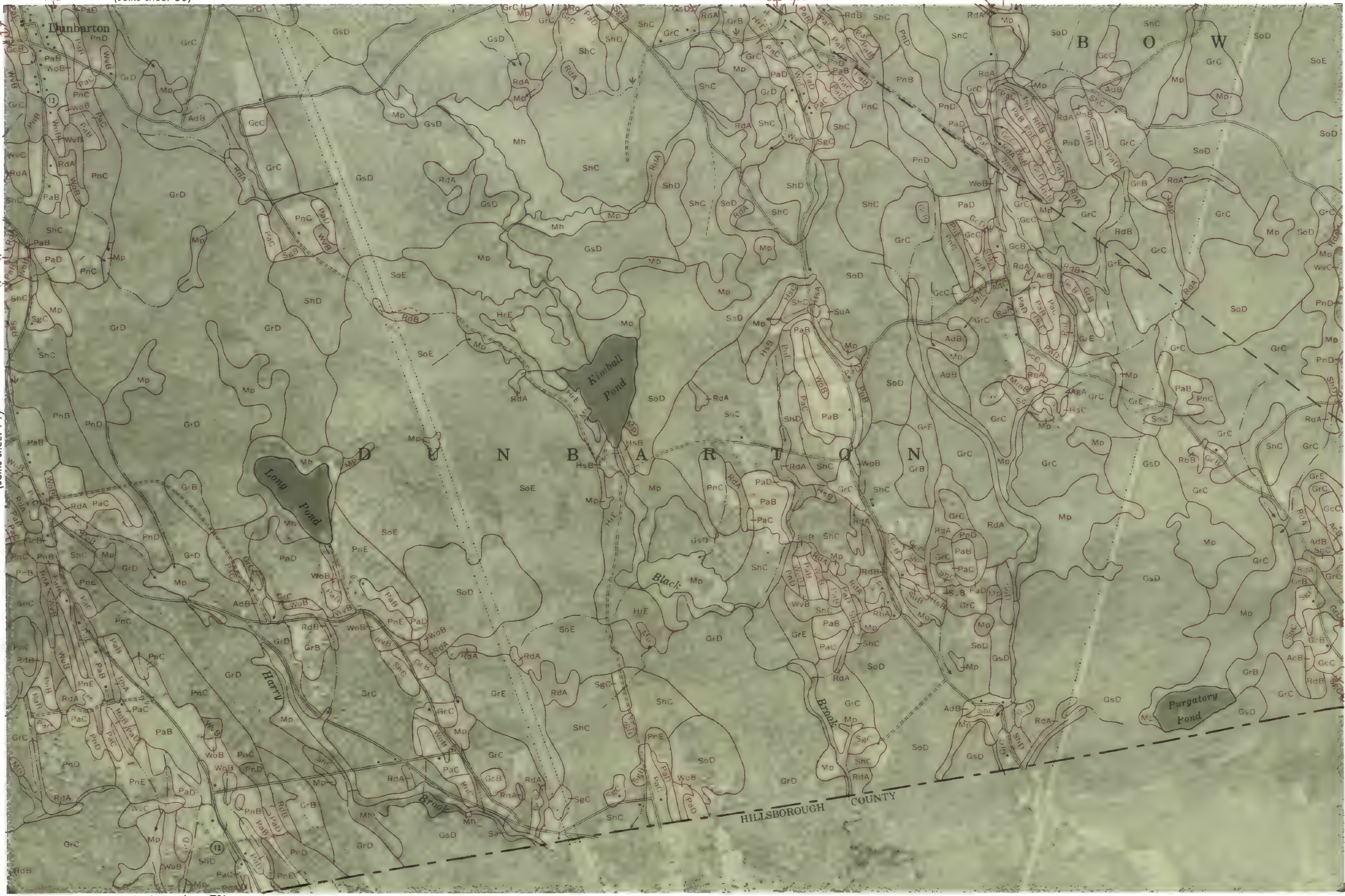


0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the New Hampshire Agricultural Experiment Station

72

(Joins sheet 68)



(Joins sheet 71)

(Joins sheet 73)

(Joins inset, sheet 71)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

73

(Joins sheet 69)

(Joins sheet 72)

(Joins sheet 74)

(Joins sheet 75)

Scale 1: 20 000

0 ½ 1 Mile

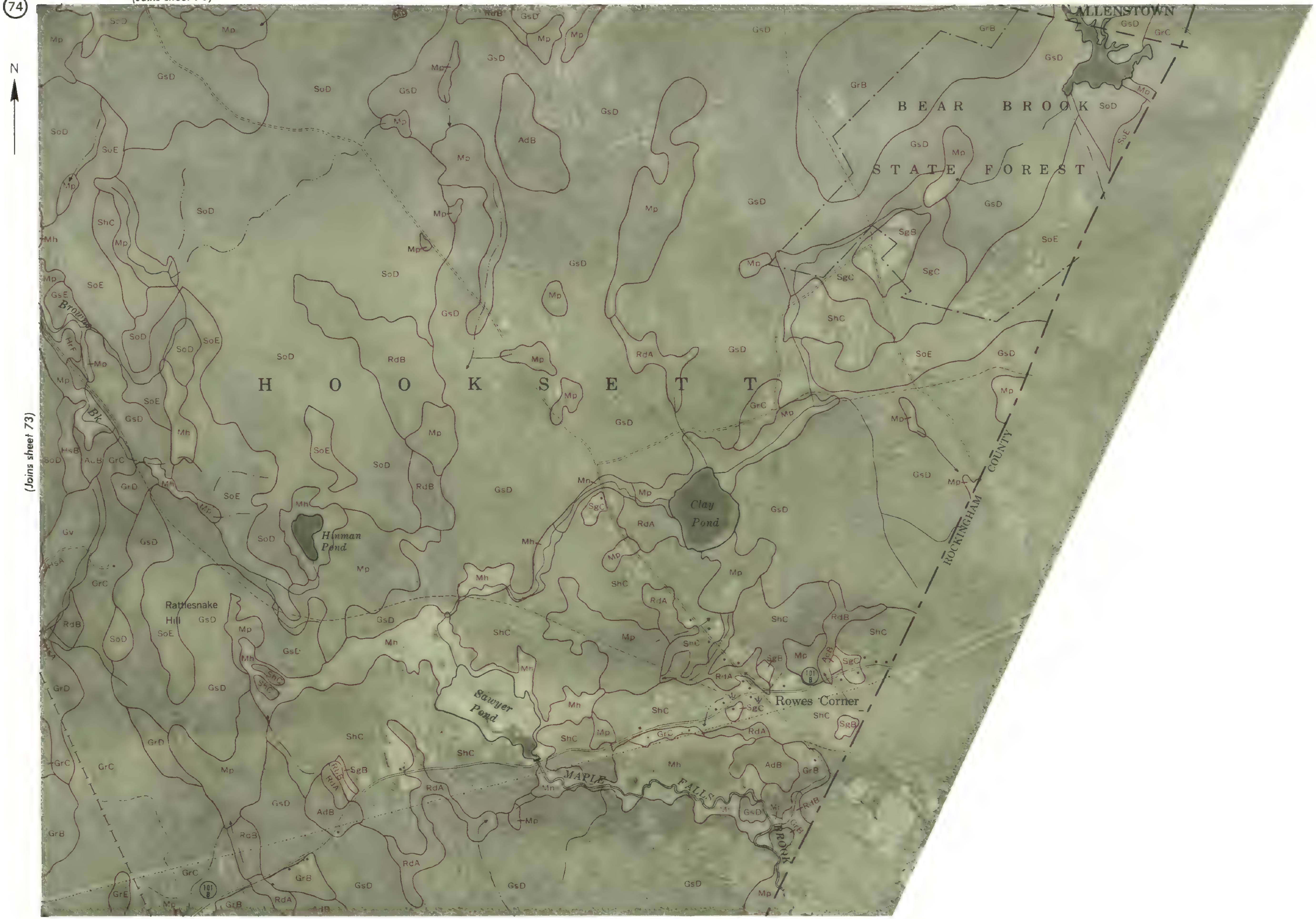
0 5000 Feet

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

74

(Joins sheet 70)

(Joins sheet 73)



(Joins sheet 76)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

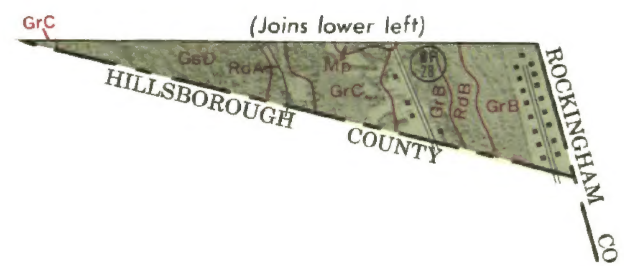
This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.

76

(Joins sheet 74)

(Joins sheet 75)

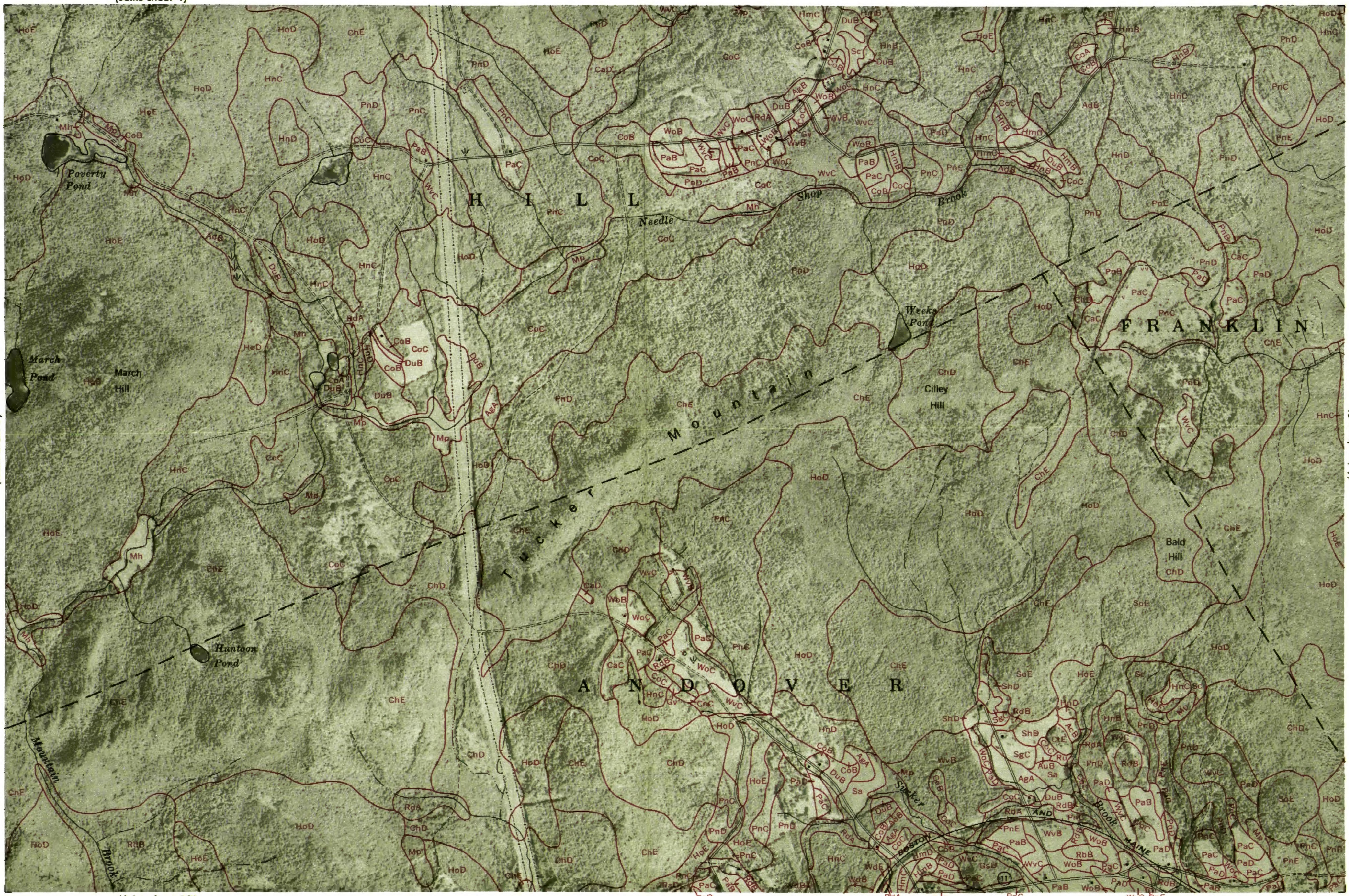
(Joins inset)



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

MERRIMACK COUNTY, NEW HAMPSHIRE — SHEET NUMBER 8

(Joins sheet 4)



(Joins sheet 13)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

9

This map is one of a set compiled in 1963 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the New Hampshire Agricultural Experiment Station.